Heating Piping & Air Conditioning

with which is merged the Aerologist

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Operation, and Maintenance:
Industrial, Commercial, Institutional,
and Public Buildings

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DECEMBER 1949 . . . Vol. 21, No. 12

The Editor's Pages (news, notes and comment)..... 61

"Open for Discussion" (a regular feature)..... 65

Minus 85 F Refrigeration for Film Processing at Kodak Park, by James H. Shaw..... 69

The Myth of the "Indoor Sun," by F. W. Hutchinson..... 74

Keeps Water in Air Conditioning System During the Winter Months, by W. A. Stahl..... 77

Automatic Damper Controls Save Oil, by Ray C. Conkle..... 79

Sam Lewis' Page—May Pay to Forget Convention in Piping Design for Heating..... 81

Split System Heats Modern School..... 82

Today's Pipe Welding Practices, by F. C. Fantz..... 84

Air Conditioning the New House of Commons, by J. R. Kell..... 88

How to Space Pipe Supports, by Theodore E. Bridge..... 90

Heating With the Heat Pump, by G. D. Wetherbee..... 93

Why Rated Hot Water Relief Valves?, by John James..... 96

Question of the Month—Practical Pointers on How to Ventilate Club Kitchen..... 98

Equipment Developments..... 139

Who's What..... 160

New Books and Reports..... 168

Meetings and Conventions..... 174

Recent Trade Literature..... 178

Index to Advertisers..... 186

Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc.

Journal Section of the American Society of Heating and Ventilating Engineers

Condensation on Prefabricated Walls, by E. R. Queer and E. R. McLaughlin..... 99

Resistance Gradients Through Viscous Coated Filters, by Frank B. Rowley and Richard C. Jordan..... 105

Texans Ready to Welcome ASHVE Members to 56th Annual Meeting, Exposition in Dallas..... 113

Eminent Society Members Attend Charter Meeting of Baltimore Chapter..... 116

President Stacey Honored at Central New York Meeting..... 117

Summary of Chapter Meetings..... 118

Candidates for Membership..... 124

In Memoriam—John Howatt..... 129

Officers, Council and Committees..... 131

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THE EDITOR'S PAGES

NEXT MONTH: The January issue of HPAC will be a big one, with a number of features. . . . A complete Directory Section of Heating, Piping, and Air Conditioning Equipment for Industrial, Commercial, Institutional and Public Buildings, thoroughly revised and brought up-to-date, will appear on the familiar yellow pages. . . . Exhibits at the Southwest Air Conditioning Exposition to be held in Dallas the end of January, and other details of the big show and the annual meeting of the American Society of Heating and Ventilating Engineers, will be "previewed" in a special Show Section. . . . These features are in addition to HPAC's regular editorial content, including the Journal Section of the ASHVE. . . . A group of articles by outstanding authorities on developments in air conditioning, heating, and piping during the first half of the 20th century will dominate the regular editorial pages. . . . It all adds up to an issue we know you'll particularly like. . . . Until then, best wishes for a Merry Christmas and a Happy New Year!

BUILDING UPSWING GAINS MOMENTUM

THE BUILDING upswing which started in August gained striking momentum in October, according to an analysis by F. W. Dodge Corp., when contracts awarded in the 37 states east of the Rocky Mountains totaled $1,061,751,000, the third highest monthly volume in the corporation's statistical series dating back to pre-boom days of the 20's.

The only other months showing a higher volume were June 1942 when construction for war purposes was at a peak, the total then being $1,190,264,000, and September of this year, when the total was $1,093,724,000.

The October building and engineering contract volume was off 3 percent from September's record, but was up 36 percent over October of last year.

The investment commitments brought the cumulative total for this year to $8,472,459,000, or 4 percent higher than in the corresponding 10 months of last year.

The October upswing was reflected in all major classifications of building and engineering works, and in both public account and private account contracts, with public account projects contributing slightly more than private work to the overall trend.

Nonresidential awards in October amounted to $357,085,000 or 3 percent more than in September and 13 percent more than in October last year. Striking gains over the two previous months of comparison were reported for educational and science building, hospital and institutional construction and public nonresidential buildings.

RELEASE ESTIMATE ON '50 CONSTRUCTION

BUILDING AND construction volume based on dollar valuation of project contracts to be awarded, will decline 4 percent next year from this year's expected total of $9,940,000,000 in the 37 states east of the Rocky Mountains, in the opinion of F. W. Dodge Corp. An analysis by Thomas S. Holden, president, and Clyde Shute, assistant vice president and manager of the corporation's statistical research division, attributes part of the anticipated dollar volume decline to an expected average 4 percent drop in square foot costs of building, and the remainder to an estimated 3 percent decline in physical volume.

The breakdown of the estimates reveals an anticipated drop of 10 percent in privately owned building and engineering works and an 8 percent increase in publicly owned building and construction.

Despite an anticipated increase of 14 percent in the dollar valuation of public residential building next year, the corporation expects an overall decline in new dwelling units of 3 percent, and a dollar valuation drop of 7 percent to develop from an anticipated decline of 9 percent in valuation of private residential work next year.

While increases in all major classifications of publicly owned building and engineering works are anticipated in the analysis, declines in private work of all classifications would indicate an overall dollar volume drop of 6 percent in nonresidential building, a 6 percent decline in nonresidential and residential combined, and a 5 percent increase in heavy engineering works, estimated increases in publicly owned projects offsetting an anticipated drop of 8 percent in private engineering and utilities projects.

CONSERVING WATER FOR AIR CONDITIONING

PROPOSED amendments to the refrigeration ordinance for consideration by the Chicago city council state that "Every refrigeration system used in connection with air conditioning for comfort cooling, employing water from the city water mains for condensing purposes, and using more than 20 gpm of water, must be provided with an approved type of means of utilizing the latent heat of evaporation of water for removing heat from the condenser. The maximum temperature rise of the water in passing through the condenser shall not be more than 35 F."

An "approved type of means of utilizing the latent heat of evaporation of water" for removing heat from the condenser, means that when more than the specified amount of water is required, an evaporative condenser, water cooling tower, or some such type of apparatus, will be employed for conserving water.

NAFM INCORPORATES

NATIONAL Association of Fan Manufacturers, Inc., is the new name of the well known trade association which was organized in 1917, as a voluntary association under the name of the Fan Manufacturers' Credit Association. By 1919—the scope of the activities having been greatly increased—the name was changed to the National Association of Fan Manufacturers as more indicative of its functions. The association was incorporated on September 1 of this year under the laws of the state of Michigan as a

THE EDITOR'S PAGES

voluntary, nonprofit organization, and the name changed accordingly. Nine of the charter members in 1917 retain their membership in NAFM, Inc., today.

The activities of NAFM, Inc., cover standards, engineering, safety, transportation, statistics, manufacturing and other industrial problems. To further this work, the association maintains membership in other organizations relating to fire prevention, transportation and industrial hygiene.

REPORTS RECORD EARNINGS

WESTINGHOUSE Electric Corp.'s dividend of 65 cents a share on the company's common stock, paid December 1 to stockholders of record November 14, brought total dividends for the year to $1.40 per common share. The dividend was made possible by the largest nine-month net income reported for any year of the company's history. For the first three quarters of this year, net income amounted to $48,964,408, equal to $3.64 per common share. This compares with $37,296,345 or $2.74 per common share for the first three quarters of 1948.

Net income for the third quarter of this year totaled $20,554,447, equal to $1.54 per common share, compared with $9,855,245 or 72 cents per common share in the same quarter of 1948.

TESTS IDENTIFY ENGINEERING ABILITY

ORAL AND written tests for engineers are approaching the goal of positive identification of engineering ability. Proof of the relation between oral and written tests and the characteristics of a successful engineer were presented to the Engineers' Council for Professional Development by E. C. Koerper of the A. O. Smith Corp.

His studies were made as chairman of the Milwaukee plan of personnel development in engineering, which set out to determine the difference in the basic abilities between individual engineers. The committee followed two definite objectives, he said, the first being to develop effective means for assaying and specifying aptitudes, interests and personal qualities of individuals in engineering work, and the second to develop a comprehensive job specification system.

The work was carried on under auspices of the Engineers' Society of Milwaukee, and a committee of the society spent three years working with the University of Wisconsin's bureau of industrial psychology and cooperating industries in creating the plan.

STEAM'S THE BYPRODUCT AT THIS STEAM PLANT

BYPRODUCT STEAM and byproduct power are common in the terminology of process industries, depending upon whether power or steam is the primary objective of generation. But it is unusual to find steam a byproduct of the process itself. This, however, is the case in the manufacture of "dry ice" from CO_2 in the flue gases by the Girbotol process, as conducted at the Chicago plant of Pure Carbonic, Inc.

With this process it is desirable to carry the CO_2 in the flue gases as high as possible to permit maximum extraction, even with some sacrifice in boiler efficiency, inasmuch as the steam is a byproduct used to drive auxiliary equipment and for plant heating.

The boiler installation, put in last spring, consists of one 30,000 lb per hr and two 15,000 lb per hr steam generators burning coke breeze on traveling grate stokers, with oil as a standby fuel, according to engineers of Combustion Engineering-Superheater, Inc.

It was recently decided to conduct a test to determine equipment capacity with a view to increasing the daily output. Accordingly, the test was carried on for a period of two weeks with the largest boiler operating at a load 20 percent in excess of its maximum continuous rating, during which time the CO_2 ranged from 17 to 18 percent with a corresponding efficiency of 65 percent. When it is considered that this efficiency concerns the byproduct steam output alone and that the primary product is maximum carbon dioxide, with extraction up to 90 percent, the excellent performance of the steam generating unit may be readily understood.

Visual inspection of the boiler, when taken off the line at the conclusion of the test, indicated less slagging than is experienced under usual operation and no adverse effects upon the refractory parts of the setting.

INDEX FOR 1949 TO BE AVAILABLE ON REQUEST

AN INDEX for our 1949 issues, Vol. 21, Nos. 1-12, including the Journal Section of the American Society of Heating and Ventilating Engineers, is being compiled and will be available soon to HPAC's subscribers on request. If you want a free copy, send a note or postcard to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

We'll keep your request on file until the index has been printed, and will then mail a copy to you.

"QUOTE"

HERE ARE A couple of "quotes" we ran across last month that appealed to us. The first is from a technical report on the standardization of thermodynamic properties of moist air, and the second was an aside during presentation of a paper on wax separation in refrigeration oils.

* * * * *

"By present day standards, Dalton's Law [on which most predictions of the thermodynamic properties of moist air have been based] must be regarded as an inaccurate conjecture based upon an unwarranted faith in the ultimate simplicity of Nature."—John A. Goff, dean, Towne Scientific School, University of Pennsylvania.

* * * * *

"If we follow this line down [on the chart shown on the screen], we run into some very fine print on the chart and some trouble in the refrigerating machine."—W. O. Walker, director of research, Ansul Chemical Co.

"OPEN FOR DISCUSSION"

DO YOU HAVE something to say about any of the articles published this month? An additional comment, or perhaps a question on some point? Or do you want to contribute your views on some other matter of interest to heating, piping, and air conditioning engineers or contractors? We follow here the custom at engineering society meetings of allowing a period for discussion following presentation of a paper. You are invited to contribute your comments. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

WHAT'S EFFECT OF HEAT ON PLASTER?

THE EFFECT OF ceiling and wall radiant panel heating on plaster surfaces is a subject on which quite a bit of research effort has been and is being expended. But it is one that needs more study, in my opinion.

In the earlier ceiling heating coil installations, the location of the coils was generally above the metal lath. Plasterers used particular care to force plaster up through the lath to cover the pipes as fully as possible. In some jobs, metal lath was even wound around the pipes in an attempt to assure better coverage and adhesion of the plaster. To assure crackfree finish coats, the system of working a scrim or thin fabric of onion sacking, jute cloth or similar material into the second or brown coat of plaster was employed in many cases.

During the war years, however, considerable research by the manufacturers of plaster products indicated certain problems that were likely to arise when construction activity again permitted any but the most fundamental essentials of heating. The recommendation that the tubes be placed below the metal lath was one of these problems. The normal thickness of plaster on metal lath is from ¾ to ⅞ in., so with a ⅜ or ½ in. tube below the lath only ⅜ to ½ in. of plaster would be available to cover the tube. For competitively priced jobs, it is impractical to think that scrims would be used to spread the forces of expansion throughout the plaster, and in fact such practice is not entirely necessary. Also, there are bound to be over-sanded jobs, jobs with dirty sand, jobs where the thickness of plaster is a bare ¾ in. and in some cases much closer to ½ in., and jobs where uneveness of the coils is hidden by excess plaster thickness in some places. The long-run quality and life of such substandard ceilings is subject to question, and to establish a reasonable standard, a minimum coverage of ⅜ in. of plaster over the tube was recommended by various plaster manufacturers.

Laboratory testing indicated that while the coefficients of expansion of plaster and copper tubing are practically the same, there is the problem of unequal expansion within the tubes as a head of warmer water goes through the coil. Unless the heat is introduced to the coils very gradually, over a period of days rather than hours, there is a definite tendency for hairline cracks to appear on the plaster surface directly under the coil. Actually, the entire coil layout or grid was "photographed" on the plaster surface. As a result, it was recommended that the heat be introduced very slowly. Under no circumstances should heat be introduced in the coils until the plaster is properly set, for if the radiant heating system is used to dry out the plaster this often results in much too rapid drying which will cause cracks.

It is believed that, if after the initial hairline cracking occurs, the cracks are filled with spackling plaster before paint is applied, no further difficulty will be encountered. However, it is recommended that the heating system be turned on very gradually at the beginning of each heating season.

Laboratory testing also indicated that water temperatures in excess of 125 F average accelerated calcining of gypsum plaster. The value of gypsum as a fire retardant lies in its ability to retain its water of crystallization. Until this water of crystallization is driven off, the temperature on the unexposed side of the plaster cannot exceed the boiling point of water, and of course the thicker the plaster ceiling or partition and the higher its gypsum content the longer it will take to drive the moisture out of the material. However continuous exposure to temperatures in excess of 125 F will result in calcining or driving the water out of the plaster. (It is to be noted that occasional exposures to considerably higher temperatures for relatively short periods of a few hours or so will not cause calcining if normal temperature and humidity conditions obtain after such exposures).

Calcining of plaster results in the development of a plaster that has insulating qualities. In other words, the greater the calcining the more heat required to get through the material to maintain a desired surface temperature. The maximum water temperature of 125 F generally can be expected to give a surface temperature of approximately 115 F on the plaster directly beneath the tube, which temperature is usually deemed desirable in rooms with ceiling heights from 8 to 11 ft. However as calcining progresses, higher water temperatures are required and as higher water temperatures are used there is more calcining. It is true that these higher temperatures will be required only during the days of lowest temperatures when the system is operating up to its full design load, and that at other times

THIS COULD GET COMPLICATED

SEEKING "dignity and business volume" (according to a news note we read somewhere the other day), a chapter of the American Institute of Architects passed a resolution to address each other on all occasions as "Architect" rather than "Mister." Hope the members of the Heating, Piping and Air Conditioning Contractors National Association don't follow suit.

"OPEN FOR DISCUSSION"

water and surface temperatures will be considerably lower.

It is generally believed that the amount of calcining of plaster will not appreciably affect its life or the strength of the normal ceiling. However, with over-sanding the heat transmission of plaster will be reduced and the effect of such practice, which is poor under any circumstance may result in accelerated plaster failure.

Thus, there is more to the installation of radiant heating in the ceiling or walls than the proper design of a good heating system. Operation of the first jobs installed in the United States indicates that the quality construction principles used thereon has resulted in sound ceilings that are in as perfect condition as ceilings in which no heating is installed. Many of the outstanding mechanical engineers are following this same practice in the design of radiant ceilings—putting the coils above the lath and using portland cement plaster or lime plaster. A few continue to specify scrims but this is not general. However, a carefully designed radiant system with tubes below the lath which in turn are imbedded in the plaster will give satisfactory results if water temperatures are kept below 125 F and if there is a minimum coverage of at least ⅜ in. of plaster over the tubes. Gypsum plaster is as satisfactory as any other type of plaster when the maximum water temperature is kept at 125 F for it is no more susceptible to hairline cracks than is any other type.

Up to this point nothing has been said about heating with air through ducts built into ceilings. Again the same surface temperature requirements are found—approximately 115 F maximum for ceilings 8 to 11 ft high. However, in place of metal lath and plaster it is common to use rock lath in order to have a smooth surface on the inside of the air duct. The thickness of plaster required on rock lath is somewhat less than that required on metal lath, generally being ½ in. However, considering the thickness of the gypsum within the rock lath, the total gypsum material through which the heat must flow is about the same in either case. However, there is paper on both sides of the rock lath and this will of course have some effect on the rate of heat transmission. With air there is not a concentration of heat at any one place as there is in a coil job adjacent to the coil; rather, the entire surface of the lath is more or less uniformly heated. The hairline crack problem is thereby eliminated, but probably higher air temperatures will have to be carried to get heat through the ceiling surface than will be true of water temperatures in a coil system. However, as the temperature is uniform, the temperature within the rock lath should not exceed 125 F. This permits a surface air temperature on the backing paper of 135 F or higher.

The purpose of this discussion is merely to point out some of the conditions existing. Where cooling through radiant surfaces is considered, additional problems arise, one being the possible effect of condensation on the plaster surface. The plaster manufacturers are making studies of all factors which affect their products. Plaster is definitely a part of the heating system in a ceiling or wall radiant heating installation.—GEORGE M. FRASER, formerly engaged in architectural promotion work for large building material supplier; now market analyst, Surface Combustion Corp.

PHYSICAL SIDE OF COMFORT

IN THE ARTICLE by C. L. Ringquist and myself on the The Physical Side of Comfort in the October HPAC, an example was given on page 73 to show the large amount of energy conversion which occurs in the human body when external work is performed. The example given was in error, and a correct example is as follows:

If the body is to move a weight of 180 lb through a distance of 15 ft, as in climbing stairs, an energy conversion within the body involving 5 x 15 x 180 or 13,500 ft-lb must occur. This is because the thermal efficiency of the body is placed at 20 percent.

One Btu is equivalent to 778 ft-lb, so 13,500 ft-lb is equivalent to 17 Btu.—A. C. MENKE, air conditioning engineer, The Trane Co.

RE-USING WATER FROM CONDITIONING PLANTS

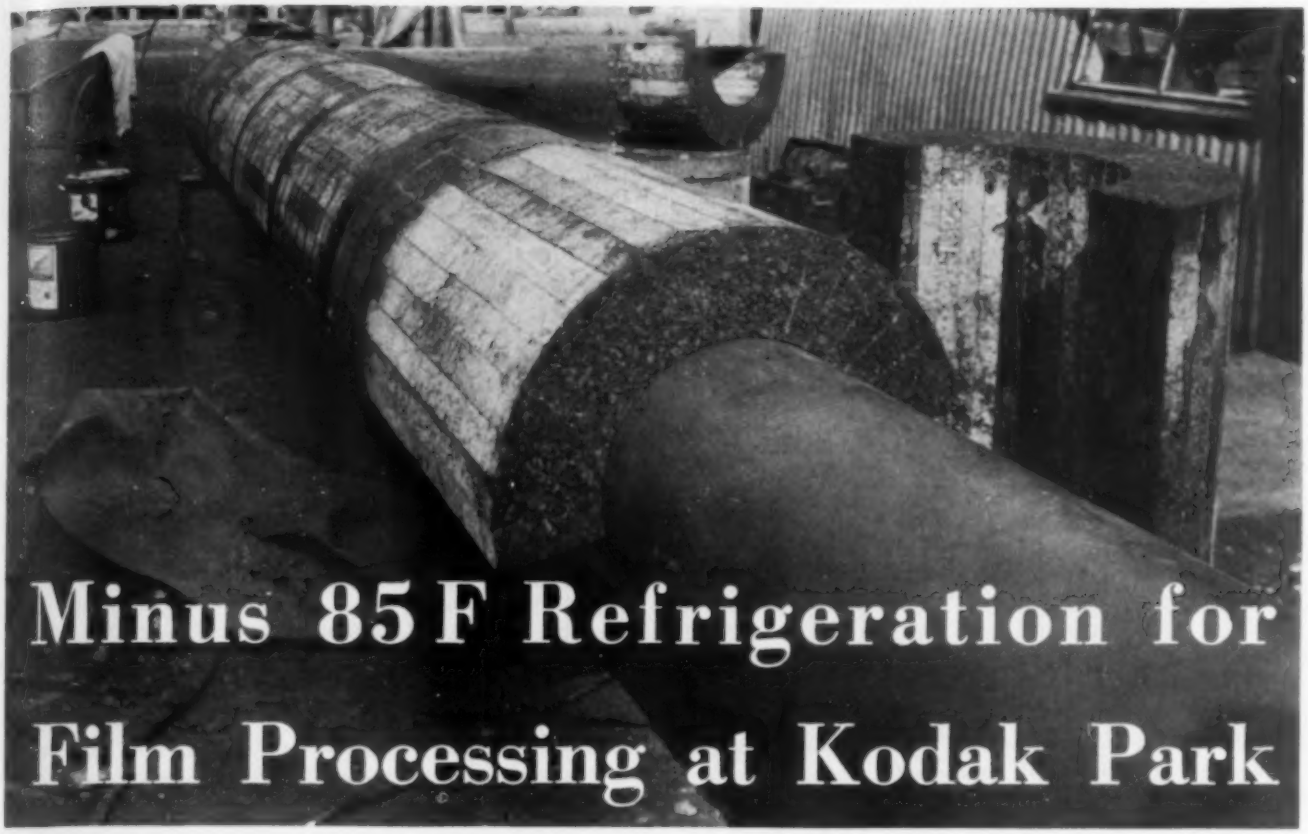
THE SHORT article on re-using water from air conditioning installations on page 62 of the November issue is timely in that it relates to the serious and constantly growing water problem now existing. With the increasing demand for water by air conditioning systems, as pointed out, the problem will not be alleviated unless something is done.

At present, the altogether too-frequent scarcity of water is keenly felt by consumers of water in many municipalities. The problem involves engineering and economics, i. e., increasing present water pumping capacities and perhaps larger sewers to carry away the warmed condensing water; making use of evaporative condensers, cooling towers, river water or sewer water for condensing purposes; or permitting the re-use of condensing water taken from city water supplies for other purposes. What shall it be?—E. P. HECKEL, consulting engineer.

A HORSE THE SIZE OF A POSTAGE STAMP

ONE KILOWATT of power, or nearly one horsepower, can be concentrated in an area the size of a postage stamp with sound that can't be heard, Norman F. Barnes, General Electric engineer, told a recent meeting of the American Institute of Chemical Engineers at Los Angeles.

Speaking on ultrasonics, sounds pitched too high to be heard by human beings, Mr. Barnes said that the high frequency sound waves are certain to prove immensely useful in the near future. "You can get ultrasonic energy into places where it is difficult to get other types of energy," he pointed out.



Minus 85 F Refrigeration for Film Processing at Kodak Park

Cork cylinders being applied to 16 in. pipe

WITH ALL ITEMS of material and procedure for the minus 85 F refrigeration system at the Kodak Park plant of the Eastman Kodak Co. settled (as described in the November HPAC), construction of the outside distribution mains got under way in August 1947. The total erected consists of 1700 ft of 12 in., 1200 ft of 14 in., 3000 ft of 16 in. and 400 ft of 18 in. pipe.

The brine distribution system is designed to circulate 6900 gpm of methylene chloride at −100 F to two separated film production buildings. The mains leaving the refrigeration plant are 18 in. OD and travel 200 ft north where they branch to two pairs of 16 in. OD lines. One pair of 16 in. lines carrying 3400 gpm extends 880 ft and runs halfway along the outside wall of one production building, is reduced to 12 in. for another 380 ft, and then the two lines are connected with a 6 in. bypass and valve. Thirty pairs of 4 in. connections with valves extend from the distribution header into the building.

The longest run of nearly straight line is 610 ft along the production building wall. Each line of this run is divided into four approximately equal sections by two anchors and a 19 ft vertical expansion loop between the anchors. Total expansion, based on 180 F acid cleaning temperature and −80 F average operating temperature, was calculated to be about 13 in. or 3⅛ inches maximum movement in each section. However, from atmospheric temperature to −80 F the movement is only about 2 in. and the 4 in. machine connections at the extremes of each section are designed for a 2 in. maximum movement.

The other pair of 16 in. mains carrying 3500 gpm extends 1050 ft to the second production department where they divide into two headers inside the building. One branch of 16 in., 14 in. and 12 in. pipe extends 290 ft and the other branch of 12 in. pipe extends 180 ft. Two anchor points are located in this second production building, one at the bottom of a vertical loop as the 16 in. lines enter the building and the other farther along inside the building on the 290 ft straight run of pipe.

Welded Piping "Threaded" Into Building

Due to physical interferences outside this second production building, the distribution headers had to be run inside the building. Because of the nature of the area (explosion hazard, etc.) no welding

JAMES H. SHAW, refrigeration engineer, Eastman Kodak Co., Rochester, N. Y., explains details of piping construction, insulation and anchoring for one of the largest refrigeration systems in existence using brine at ultra-low temperature. He describes also the turbine driven centrifugals, their control, the brine pumps, etc.

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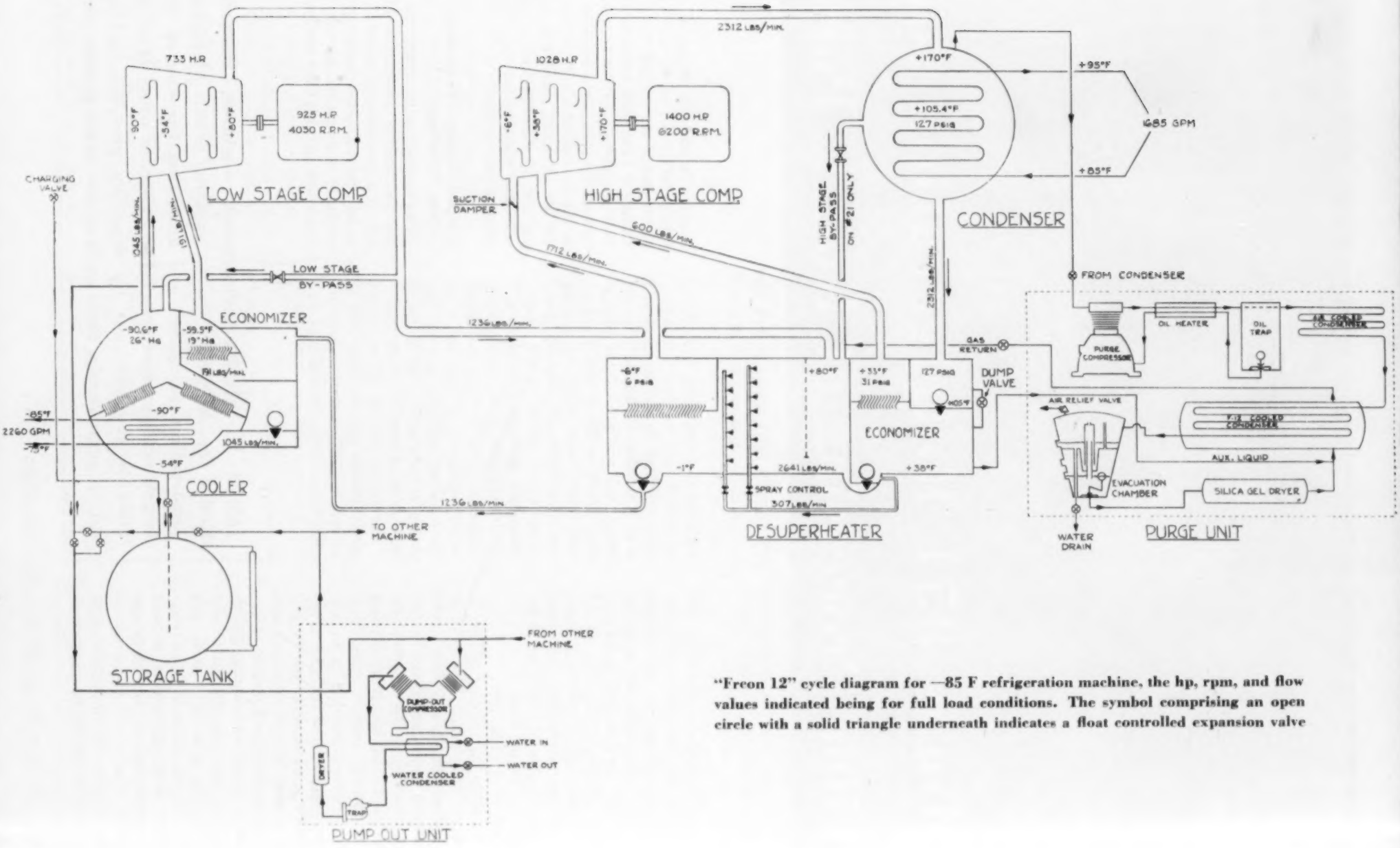


"Freon 12" cycle diagram for —85 F refrigeration machine, the hp, rpm, and flow values indicated being for full load conditions. The symbol comprising an open circle with a solid triangle underneath indicates a float controlled expansion valve

could be permitted inside. Therefore, supply and return headers of 16 in. reducing to 12 in. were welded up one length at a time outside the structure on an elevated platform 30 ft above ground and threaded into the building as each length of pipe was added. These headers, each approximately 290 ft long, have thirty-two 4 in. connections welded to them—one pair of 4 in. connections for each production machine condenser. Due to good welding practice none of the welds on the indoor headers leaked on test or in operation.

Of a 1000 total estimated number of welds made in the large piping by two welders certified for this work, not one leaked when tested up to 190 psi hydrostatic pressure or in operation at −85 F.

Some difficulty was experienced in joining the pipe to welding neck flanges. During this welding, small "explosions" took place which blew the molten metal out of the welding bevel. This occurred as many as half a dozen times around a 14 in. weld. One explanation was that in the manufacture of the forged flanges, excess nickel accumulated at the ends of the neck of the flange and some remained even after the machining operation to cut the bevel. The exact cause was never determined but a good weld certainly could not be obtained.

On the theory of excess nickel, we burned off about ½ in. of the neck. The flange then made a perfect weld with the pipe. All of the flanges from 16 in. to 2 in. were thus burned off before attempting to weld and all succeeding welds were good.

Installing Insulation on Low Temperature Piping

On our −36 F calcium chloride brine system, the cork covering has required repairing, patching up after new connections, etc. This we do quite easily by using alcohol to keep the frost away while the cork is being applied with a line in service. However, with −85 F in our new system, it seemed that such a procedure would be difficult and a poor cork repair job would result. Therefore, every effort was made to be sure the best possible insulation job was done, both in choice of material and workmanship.

Several insulation materials were investigated but cork was chosen for this application because of its resistance to crushing and puncture of vapor seal, workability and ease of installation. For many years, we have cut and installed our own cork covering on innumerable tanks, miles of piping, storage rooms, etc. We have a well equipped shop for cutting lags and odd shapes and a well trained crew of cork coverers.

The cork thickness is 6 in. on all lines down to 2 in. and 8 in. on the refrigerating machine coolers and compressors. On the first half of the project, the cork on the lines was made up in cylinder halves and applied as shown in accompanying photos. On the second distribution lines, the cork was applied with the lags staggered.

It was at first thought that making up the cylinders beforehand in the cork shop would cut the labor cost of installation. This did not prove to be the case because it was found that difficulty was experienced in getting the adjacent cylinder edges to butt evenly against each other. This difficulty with some cylinders was caused by unequal length of the lags which we found varied as much as ⅛ in. in a 3 ft lag. By staggering the lags around the pipe (our old method) with each lag butting tightly against its neighbor, the slightly unequal lengths became insignificant.

All possible cork was applied with the pipe on the ground, with two lengths of pipe welded together to make a total assembly of about 40 ft. No weld was covered until the lines were completely installed and the final test given.

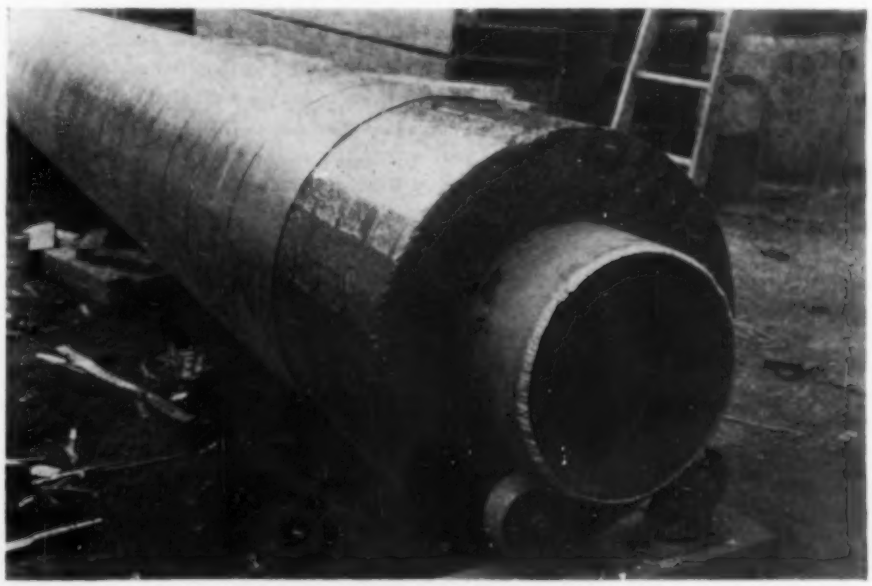
After a section of piping was covered, the cork was vapor-sealed with hot asphalt mopped on and then covered with roll roofing. The cork is held in place by ¾ in. galvanized bands on 6 in. centers, while the roofing is held by ½ in. bands on 9 in. centers.

Insulating Valves and Flanges

At all valves and flanges, the small voids between the lag covering and the metal were filled with fine granulated cork and then hot paraffin poured in. We found by experimenting that 108 F melting point paraffin at about 120 F did a good job of penetrating into all voids where the granulated cork was located. The covering on one valve was removed for inspection before the system went into operation and we found all the voids perfectly filled with a pliable cork-paraffin mixture. Our tests showed that the fine cork did a much better job of filling even the remote voids than a coarse granulated cork.

The low melting point paraffin was chosen against higher melting point waxes because the danger of burning a workman in case of a spill or splash is practically *nil*. We

Cork covered line ready for hoisting into position. The cork has been hot asphalt vapor-sealed and roofing paper has been installed. Wood slat slings at the center of the line were used for hoisting so the cork would not be crushed



have now standardized on this method of covering valves, etc., on all of our cork covered systems and have abandoned the not too satisfactory old method of using brine putty.

At all points of support, high density cork lags instead of standard cork lags are used under steel saddles in the shape of half cylinders. The length of the saddles was designed to give a compressive stress in the high density cork of not over 25 psi calculated from the projected area or outside diameter of the pipe. This loading on the high density cork gives a deflection of about 9.5 percent and is not excessive. Standard cork would not carry our design loads without very short spans and excessively long saddles.

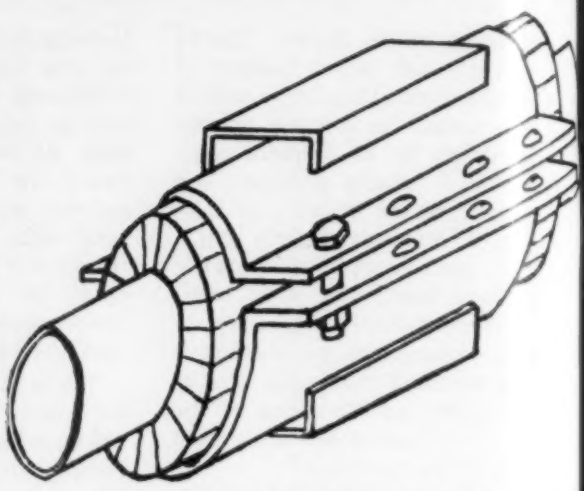
Anchoring the Cork-Covered Lines

There are three pairs of anchors on the piping system. In the design stage, when the need for anchors became apparent, the problem of installing them on lines designed for −100 F without having frost and cork damage difficulties later on presented a puzzle for a time.

The anchor finally designed and used is shown in an accompanying sketch. It consists of two steel half cylinders with flanges running parallel with the pipe and high density cork completely around the pipe under the steel half cylinders. The cork was cemented to the pipe line, the cork vapor-sealed, and the cylinder halves cemented to the cork. Then the cylinder halves were drawn down by bolts in the flanges on each side until the flanges came together. The tightness of the cylinder halves when drawn together was such that a calculated 13.5 psi pressure was applied against the pipe surface. The extra load carrying capacity in the cork at the anchor was used up carrying the pipe span load. We assumed that high density cork would stand 5 psi stress in shear and designed the length of the steel cylinder to produce not over this amount with the calculated lateral pull on the pipe line due to temperature change. The installed cylinder was then welded to a braced structural support. No evidence of failure, slippage, frost or any other difficulty has been found at any of the six anchors after a year and a half of operation.

Methylene chloride is one of the best paint removers we have run into; it also will attack the binder used in cork insulation. Stuffing box type valves, when used frequently, tend to leak around the valve stems. Even a tiny leak of methylene chloride that vaporizes as soon as it hits the air will damage cork binder. In order to prevent possible damage to the cork on our numerous large valves, various paints and liquids were investigated as a protective coating on the cork at the valve stuffing boxes. None was found which is completely satisfactory. Some withstand the methylene chloride but are dissolved by moisture which is present together with ice around the exposed end of the valve stems. Poly vinyl alcohol probably would be the best protection if no moisture were present.

We have installed galvanized sheet metal shields drawn tightly against asbestos string packing to the metal part of the valve just below the stuffing box. This—together with frequent inspection by the operators of the service valves—seems to have eliminated further cork damage.



Typical anchor used on 16 in. lines with 6 in. thick cork covering. When installed, steel cylinder flanges were drawn tightly together

Turbine Driven Centrifugals

The present refrigeration equipment consists of two centrifugal "Freon 12" machines, with a third unit in the erection stage, and the fourth unit scheduled for early 1951 operation. Each machine is identical and includes a cooler, low stage centrifugal compressor driven by a 925 hp steam turbine at 4030 rpm, a spray type heat interchanger or desuperheater, a high stage centrifugal compressor driven by a 1400 hp steam turbine at 6200 rpm, and a condenser.

Each machine is designed for a capacity of 375 tons with −85 F brine leaving the cooler at 2260 gpm and 1685 gpm of 85 F cooling tower water. The turbine drives are oversized to enable operation at −100 F with 325 tons capacity and at −65 F with 480 tons capacity, which are the maximum calculated capacities of the refrigeration equipment at those temperatures. The turbines are supplied with 420 F, 130 psig steam at the throttle and exhaust at 6 psig. This 130 lb steam is obtained from the bleed or exhaust of 800 psi, 750 F steam turbines driving our electric generators.

The material in the cooler shells is nickel steel, the heads and waterboxes are cast nickel steel and the tubes are ¾ in. prime surface nickel steel. The low stage compressor casing also is cast nickel steel. The other shells and compressor are of standard construction.

The refrigerant level in the coolers is indicated by a double glass vacuum tube liquid level gage. Although the manufacturer of this level indicator does not recommend its use for service at −100 F, it has proved to be most successful with no interfering frost, leakage or other faults detrimental to a clear, true reading. The gage glasses on the two "Freon 12" storage tanks are high pressure boiler type level indicators.

All of the shells of the refrigerating equipment are located in the basement with the turbines and compressors mounted directly above on structural steel supports. The steel is installed on its own concrete piers and is independent of the building structure. Steel floorplate surrounds the equipment on the operating floor and is isolated from the supporting steel members by sheet gasket material cut in

strips. The floorplates were isolated to eliminate (or, at least, to reduce) the possibility of drumming due to vibration. The whole installation design was carried out with noise and vibration elimination in mind and has proved quite successful.

A 6000 lb capacity "Freon 12" storage tank for each machine is located in the basement. Only one pumpout compressor unit is used and by interconnecting piping, the refrigerant can be moved to or from either machine from or to either storage tank.

Oil from the compressors that inevitably finds its way to the coolers is removed by dumping the "Freon" charge to the corresponding storage tank and evaporating the "Freon" back to its cooler by use of the pumpout compressor. A filter is used with the pumpout unit to catch any foreign material.

Control of Turbines and Compressors

The brine temperature is controlled by speed regulation on the two turbines. The low stage turbine speed is regulated by an electronic type temperature recorder controller which is actuated by the brine temperature leaving the cooler and in turn controls air pressure on an air diaphragm motor connected to the turbine speed governor mechanism. The high stage turbine speed (so as to balance the load between the high and low stage compressors) is controlled by a pressure recorder controller actuated by the intermediate "Freon" pressure which is the low stage compressor discharge pressure or heat exchanger pressure.

The cooler pressure runs around 26 in. of mercury vacuum corresponding to about —90 F evaporating temperature. The intermediate pressure, which can be regulated by manually setting the control pressure on the high stage compressor controller, is about 0 lb gage to 1 or 2 lb gage. The "Freon" condensing pressure, varying with the cooling tower water temperature, runs 80 to 120 lb gage.

Other controls, of an emergency nature, trip out the turbines in case of low oil pressure and high oil temperature on the compressors. These controls, in addition to shutting down the unit, also sound the plant annunciator horn. A high "Freon" condensing pressure control is designed and installed to bleed in plant service water through an air diaphragm operated valve; the plant horn is sounded when this occurs.

Additional instruments record the brine flow, brine temperature range, and steam flow, pressure and temperature on each machine. Condensing water flow is shown on an indicating type flow meter.

With so many centrifugal machines in the plant and more to come, the plant emergency warning system has been simplified. A single master annunciator, centrally located, has a window or drop for each centrifugal machine. Each individual unit has its own annunciator with the several drops connected electrically with the various emergency controls. On a warning horn the master annunciator indicates which particular machine has caused the disturbance and the machine at fault indicates where the disturbance has originated.

The Brine Pumps and Their Drives

Two single suction brine pumps are installed with each refrigeration machine. The pump casings and impellers are nickel steel. Each pump is rated at 2300 gpm of methylene chloride at —85 F with 75 ft head and 81 percent efficiency. One pump is motor driven by a 100 hp, 440 volt motor and the other pump is driven by a 110 hp steam turbine with reduction gear (both at 1200 rpm). Either pump can deliver 375 tons capacity.

The pump shafts are sealed with double carbon rings, spring loaded, plus a third seal of the soft packing stuffing box type. The carbon ring seals are liquid cooled and sealed with methylene chloride circulated through a small line from the pump discharge nozzle to the pump suction nozzle.

Pumping losses to determine pump head were calculated from standard friction loss tables for water with $C = 100$ by applying a multiplying factor of 0.582. This factor was calculated and as nearly as we can determine without elaborate tests, the multiplier is fairly accurate for our large size pipe. Since the brine lines will always remain clean as new inside, the friction loss is roughly equal to the loss with water in new clean pipe.

Single suction pumps were selected so that only one shaft seal would have to be maintained and the possibility of leaks reduced, and so that the cork covered pump casing would not have to be disturbed to remove the impeller for maintenance, etc. A closed tank in the basement under the pumps is provided to drain out the pumps whenever one has to be opened up. The brine in the tank is then pumped out to the main brine storage tank.

Pumps Mounted on Cork

The brine pumps are installed on the operating floor level on structural steel members. To eliminate the possibility of frost reaching the steel floor plates and also to eliminate possible vibration transmission, the pumps are mounted on cork. A steel box was fabricated and welded to the floor plates, it was lined with 4 in. thick high density cork on the four sides and bottom, anchor bolts were set in place and the cork lined box was filled with concrete. The pumps were then leveled and grouted in on these floating concrete blocks. These foundations have functioned satisfactorily in operation.

Expansion joints, with nickel steel flanges and trim and copper corrugations, are used on the suction and discharge of the brine pumps. These were installed to eliminate pipe temperature stresses from being transmitted to the pumps.

The pumps are completely covered down to the bases with 6 in. cork, with all voids filled with fine granulated cork and paraffin.

The cooling tower pumps are located in the basement because of lack of available space on the operating floor. There are three pumps, two motor driven and each rated at 1700 gpm, and one turbine with reduction gear driven rated at 3500 gpm. These are standard double suction pumps, all with 95 ft head, and operate at 1750 rpm. The big steam driven pump with 110 hp turbine will handle both refrigerating condensers while the motor driven units are designed for individual machines. The water piping is interconnected so that any pump can work with either machine and act as spare on the other.

Panel heating does a good job indoors—but not because it duplicates the radiant heat from the sun, which keeps these swimmers at Sun Valley from freezing (photo courtesy United Air Lines)

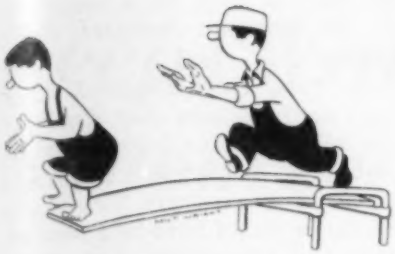
THE MYTH OF THE "INDOOR SUN"

F. W. HUTCHINSON, professor of mechanical engineering at the University of California, Berkeley, is internationally known for his research in and writings on radiant panel heating. He shows here that panel heating does a good job—but NOT because the panels transfer an appreciable amount of energy by direct radiation, as does the sun

WE ARE ALL aware that comfortable warmth can be experienced outdoors on a cold, clear day provided one stays in the sun. Because this fact is simple and because it is generally known, it has been responsible for a surprising misunderstanding. Practically all laymen —and a large number of engineers and contractors—think of a heating panel as a kind of "indoor sun" which effectively transfers energy to the occupant by direct radiation. But such is not the case.

Panel heating is a good method of heating (many hundreds of successful installations are witness to this fact) but its success is largely due to the fact that heating panels do *not* transfer an appreciable fraction of their energy by direct radiation to the occupant. Panel heating is successful because an extremely large percentage of the energy leaving the panel goes directly or indirectly into convective space heating.

In a room 20 by 20 ft with an 8 ft ceiling, less than ½ percent of the energy leaving an overall floor



panel would be radiated to the occupant and less than 1 percent would be radiated to the occupant from an overall ceiling panel; for a similar room with greater ceiling height, the percentage transferred by direct radiation to the occupant would be even less. Thus, in a 20 by 20 ft room of any ceiling height and with any type or location of panel more than 99 percent of the heat given off by the panel would, directly or indirectly, appear as convection heating. [See the appendix for computations and references substantiating the values.]

Direct Radiant Transfer Negligible

It should thus be evident that the practical importance of direct radiant transfer is negligible. Heating panels serve primarily to distribute heat by convection and to warm the ambient air within the room. A well-designed panel heating system is therefore effective because it provides uniform space heating by convection. Such radiant advantage as may be possessed by panels is due not to the radiant energy that they may supply to the occupant but rather to the reduction in radiant losses to cold floor, ceiling, or walls that the occupant might otherwise experience.

Fails As an Indoor Sun

The extent to which a heating panel "fails" as an "indoor sun" can be recognized in terms of a direct comparison. An average-size person facing south at noon on a cold, clear winter day would receive from 1500 to 2000 Btu per hr by direct solar radiation [see appendix]. An average-size person standing in the center of a 20 by 20 ft room heated by an overall floor panel at 85 deg surface temperature would receive less than 5 Btu per hr by direct net radiation from the panel. Thus, a 400 sq ft floor panel operating at maximum design surface temperature would be less than 1/300 as effective as the winter sun. For a ceiling panel (8 ft ceiling height) in the same room and at a design surface temperature of 100 deg, the direct radiant transfer from panel to occupant standing at the room's center would be 70 Btu per hr; thus, this ceiling unit of 400 sq ft would be only 5 percent as effective as the winter sun.

By raising the design surface temperature of a heating panel, it is possible to transfer directly to the occupant more Btu per hr than indicated in the above examples. Even if this were done, however, the overall result would be the same because the percent transfer by convection would not change. This means that for any structure with a normal ventilation rate and of average construction, the inside air temperature associated with the higher direct radiant transfer would necessarily be too warm for comfort. The conclusion is inescapable that for structures having low rates of natural ventilation there is no possibility of achieving an appreciable radiant heating effect from a low-to-moderate temperature heating panel.

It is evident that a large part of the popular interest in panel heating has arisen through misunderstanding. Panel systems are often referred to as affording "radiant" heating and in the popular mind a heating panel is pictured as a glamorous "indoor sun" which "bathes the occupant in its gentle, soothing, heat rays." Very rarely has any technical innovation in the field of heating gained the publicity or the rapid acceptance that has been accorded panel heating, and it is unfortunate that this acceptance should be, in some measure, based on a misconception of what the system is, of how it works, and of what can be expected of it.

Fortunately, a capably designed panel heating system does the very thing that its most rabid advocates want it not to do; it provides effective distribution of convective heating and hence is a method of raising the air temperature within an enclosure and of thereby establishing occupant comfort through general space heating. On this basis and in this way, panel heating does an effective job.

Appendix—Percent of Radiation

The heating effect of a warm surface, or panel, is due in part to the heat which flows by convection from the surface to the adjacent air and in part to emission of radiation from the surface in all directions. Research[1] has shown that approximately 70 percent of the energy leaving a ceiling panel is in the form of radiation whereas radiant transfer from a floor panel amounts to slightly less than 50 percent of the total heat transferred. Since each small element of panel surface radiates energy in all directions it is evident that only a fraction of this radiation will be intercepted by the occupant; the remainder will strike walls, furniture, etc., where it will be absorbed (raising the temperature of the receiving surface) and then dissipated as conduction loss to the outside, as convective air heating effect, or as secondary radiation within the room; usual surfacing materials—excluding only polished metals—have absorptivities of the order of 95 percent or more so there is no appreciable reflection of radiation within the room.

The problem of determining what fraction of radiation is received by the occupant is complicated by the fact that the human body is of complex shape. Experimental studies using a dummy to represent an average man have provided data[2,3] which permit the precise determination of intercepted fractions for any position (standing, sitting) of the occupant and for any location of the occupant with respect to the heating surface. For a standing occupant in a room with a heated ceiling 8 ft high the direct radiant transfer from various ceiling areas to occupant varies from a maximum of 4.7 percent to a minimum of ½ percent (occurring 10 ft out from any small area). For a standing occupant in a floor heated room, the maximum direct transfer is 8 percent and the minimum, at 10 ft, is ½ percent. Although the maximum is greater for the floor panel and the minimum is the same for both types of panels, the average value for a floor panel of appreciable size (10 ft by 10 ft or greater) is usually somewhat less than for a comparable ceiling panel because of a more rapid falling off of the

intercepted fraction as a function of distance.

By a method which is described in the literature[2] the intercepted fraction for a 20 by 20 ft floor panel (occupant assumed standing at the center of the floor) can be established as 0.0106 or practically 1 percent. Similarly, the intercepted fraction for a 20 by 20 ft ceiling panel (for same position of occupant and for 8 ft ceiling height) is found to be 1¼ percent. Thus, 1 percent of the radiant energy leaving a 400 sq ft floor panel is transferred directly to the occupant but since only 50 percent of the energy dissipation from such a panel is by radiation, it follows that the direct radiant transfer from panel to occupant is 1 percent times 50 percent or ½ percent of the total panel output. For a ceiling panel the direct radiant transfer to occupant amounts to 1¼ percent times 70 percent or approximately 0.8 percent. In either of the above cases the fraction transferred directly would be less than the indicated value for any position of the occupant other than at the center of the room.

The net transfer of radiant energy from panel to occupant can be evaluated from the usual radiation equation,

$$q = 0.172 \times F \times A\,[(T_p/100)^4 - (T_o/100)^4]$$

where

q = radiant transfer rate from panel to occupant, Btu per hr;
F = shape factor (intercepted fraction) of occupant with respect to radiation emitted by the panel;
A = panel area, sq ft;
T_p = absolute surface temperature of the panel;
T_o = absolute surface temperature of the clothed occupant.

For a 20 by 20 ft ceiling panel operating at 100 deg, substitution of values in the above equation (taking clothed surface at 83 deg) gives a net direct transfer rate of 70 Btu per hr. For a similar floor panel operating at 85 deg the transfer rate is found to be 4.5 Btu per hr.

In comparing irradiation from a heating panel with irradiation from the sun, attention should be given to qualitative characteristics as determined by spectroradiometric distribution as well as to rates of radiant transfer. In terms of heating effect alone, however, the rate of reception of solar energy on a vertical surface facing south at noon on a typical winter day (assuming clear weather) is of the order of 250 Btu per hr per sq ft of vertical receiving surface. The average area of a clothed human body is taken as 21.6 sq ft effective for convective transfer and 19.5 sq ft effective for radiant transfer; thus an average person facing south would have a projected area, in the east-west plane, of from 6 to 8 sq ft. Conservatively taking the smaller of these values and multiplying by the 250 Btu per hr irradiation rate gives 1500 Btu per hr as the rate of direct radiant transfer from sun to person.

References

1) Wilkes and Peterson, Radiation and Convection from Surfaces in Various Positions, ASHVE Transactions, Vol. 44, 1938, p. 520.

2) Hutchinson, Experimental Evaluation of Human Shape Factors with Respect to Floor Areas (Submitted to ASME Heat Transfer Papers Committee, 1949).

3) Raber and Hutchinson, Optimum Surface Distribution in Panel Heating and Cooling Systems, ASHVE Transactions, Vol. 50, 1944, p. 231.

AIR POLLUTION POSES A NUMBER OF PROBLEMS

ALTHOUGH INDUSTRIAL hygiene experts have made remarkable progress in controlling air pollution in factories and entire plant areas, a number of problems still need to be solved by research, according to Frank A. Patty of General Motors research laboratories, in an article on air contamination standards for the quarterly journal, Standards World.

In tackling air contamination both inside and outside industrial plants, hygienists and toxicologists are confronted with:

1) Insufficient data on physiological effects continued exposure to contaminants has on human beings.

2) Lack of standards or "benchmarks" for permissible concentrations of air contamination—concentrations actually safe for human beings.

3) Fear that "unnecessarily severe and impractical limits" will be set for controlling air contaminants.

4) Conflicting viewpoints of experts on the subject, because much about air contamination is still unknown.

These problems, he explained, still confront experts after more than 10 years of study by a committee of the American Standards Association.

Mr. Patty believes hygienic limits "are desirable and they should be set without undue delay for materials . . . . in industry" that might be harmful to workers. Such benchmarks or limits have long been established throughout G.M. operations, he said. They comply with recommendations of the U. S. Public Health Service and other governmental agencies.

He also advocates "bases" for air pollution control standards. These bases, he explained, might be governed by the physiological responses of man and animals to various air contaminants, sensory or "comfort" limits, good engineering practice and fire and explosion control.

Plant managers and engineers "must have some sort of milestone to differentiate between safe and unsafe or good and bad practice."

Such a standard must be based on "all factors such as health, safe practice, engineering, practicability, economic possibilities and employe satisfaction," he said. This, he contended, would be better than a benchmark stemming from "offhand estimations by single groups or individuals, and sometimes from biased or unqualified sources.

"The permissible concentration of material is one factor to be considered when selecting products for use in industry. The plant or maintenance engineer must have a basis for calculating his ventilation so that all interested parties have a common ground for reaching accord," Mr. Patty wrote.

One objection to such benchmarks, he pointed out, would be the possibility of fixing them in legal codes "instead of leaving them flexible . . . . to fit the accumulation of knowledge upon which to revise the tentative standards." Such legal codes, he said, could react to the disadvantage of the plant worker rather than to his advantage.

Mr. Patty explained that not all contaminants can be standardized as to their physiological effects on plant workers. He added that "nutrition is a very important factor in health maintenance and therefore must have a tremendously important influence on the physiological effect of atmospheric contaminants"

[*Concluded on page 78*]

Keeps Water in Air Conditioning System During the Winter Months

W. A. STAHL, operating manager of the Merchandise Mart, has found that a number of advantages result from retaining the water in the chilled water air conditioning system over the winter, which he explains here. A heat exchanger in one of the branch lines is thermostatically controlled to prevent freezing when outdoor temperatures are low

IN AN AIR conditioning installation in which chilled water is circulated through cooling coils, the problem of draining the coils at the end of summer in order to prevent freeze-ups during winter must be given careful consideration. High pressure air is often used to blow out the trapped water lodged in low pockets of the coil. Even in cases where this has been done thoroughly, the air may fail to remove all of the water and freezing has resulted.

Even with coils having large drainage openings in the headers or manifolds, and using large volumes of low pressure air to blow out the water, trouble has been experienced; although the theory is that the large air volume is less likely to bypass the water in the coil. Buildings which have experienced coil freeze-ups have taken the further precaution, after the coil has been drained, of pumping an antifreeze mixture through the coil with a small portable pumping outfit, and then re-draining the coil, any residue left in the coil thus being the antifreeze solution.

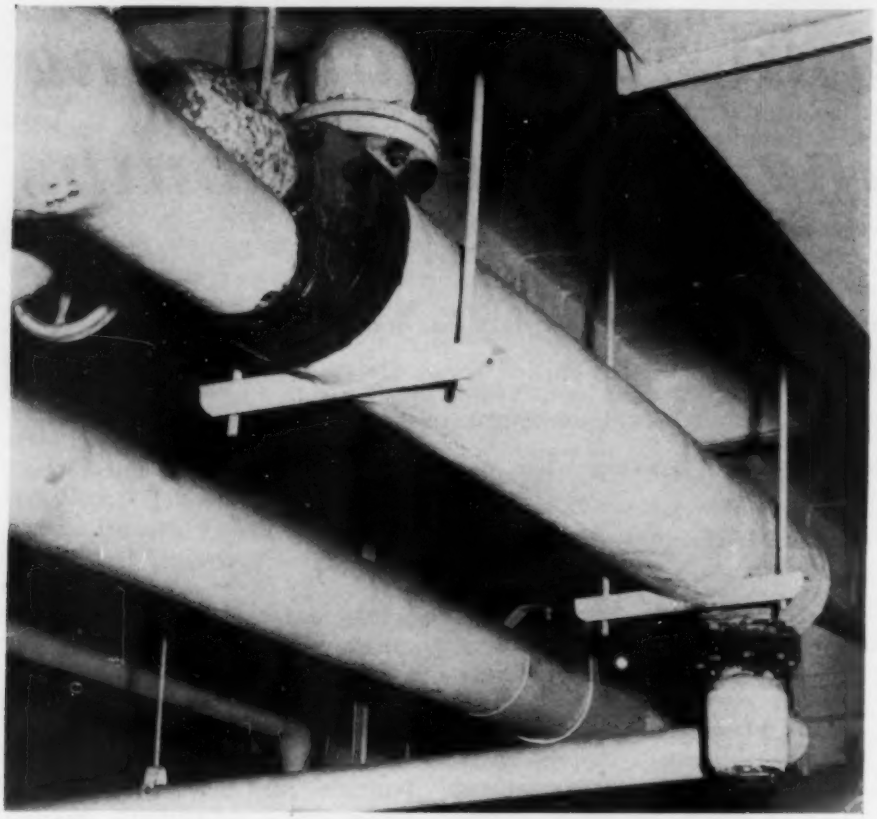
With a large air conditioning plant, the time required for winter shutdown is considerable; also, the timing of such shutdown is difficult to determine. Oftentimes, freezing weather is experienced in the middle of October, and it is necessary to drain down the system. Then, several days later, the temperature rises, frequently with high humidity. Tenants who have been sold on the year 'round air conditioning idea naturally expect their spaces to be comfortable. It is almost impossible, of course, to put the system back into operating condition as quickly as would be required.

Cooling is often needed in the Merchandise Mart in winter, particularly during the January international home furnishings market when large crowds congregate in the various showrooms

Cooling Needed in Winter

In the Merchandise Mart, big Chicago building, it was found that there was often a need for cooling during the middle of the winter. For instance, at the January international home furnishings market, when large crowds congregate in various showrooms, and especially with modern high intensity lighting (often 8 watts per sq ft), spaces become uncomfortably warm. It is not unusual for us to have temperatures in the 50's in the early part of January, with very high humidity. When this air reaches the fan room (especially where intake runs are long) it is not cool enough to maintain comfort conditions in the space.

Our solution at the Mart is to retain the chilled water system during the entire winter. A heat ex-



Water retained in the Mart's air conditioning system over the winter is prevented from freezing during low outdoor temperatures by this steam heat exchanger installed in one of the branches of the chilled water piping system

changer was put into one of the branches of the chilled water system. The steam valve is thermostatically controlled so that the water can be kept at a predetermined temperature. One of the pumps is kept operating whenever freezing temperatures obtain. As an additional safety factor, the preheating coil goes on at 35 deg. In practice, the heat exchanger can be used for heating during the "marginal heating period" when very little warming of ventilation air is required.

There is a great advantage from the corrosion standpoint in retaining the water in the system. Anyone who has operated a chilled water system for 10 years or more knows that a great deal of rust scale forms during the winter season—which, unless proper straining arrangements are made, will clog up the cooling coils. It is good practice in any system to install either pipe line filters at each fan room or a large strainer in one of the trunk chilled water lines. Our own experience has been that individual filters in the fan room are very satisfactory.

During 1949, the cooling in the building was on for five days during the first part of January. It was also on for several days in February and March. While the overall operating expense increases slightly by maintaining cooling during what is normally considered the winter period, the basic investment in a large air conditioning plant is such that this additional expense seems justified.

AIR POLLUTION—

[*Concluded from page 76*]

in an industrial plant.

"The defensive effects of diet have been inadequately studied and the part that nutrition may play in fixing hygienic standards of air contamination is, as yet, essentially a closed book," Mr. Patty wrote.

"We may never be able to establish positively safe limits of contamination for toxic materials applying to all persons at all times and yet have the limits compatible with good industrial and engineering practice.

"No matter how carefully our standards are established, if they are maintained at a level compatible with industrial survival, there may be an occasional case of illness in the especially susceptible individual.

"We perhaps should be content to make industrial disease a rare and reversible condition rather than attempt the improbable goal of complete eradication," Mr. Patty wrote. "Physiological effects must not be confined to permanent injury but should include nausea and other real signs of distress."

Outdoor Standards Hard to Fix

The article said standards for outdoor atmospheric pollution are "infinitely harder to fix than . . . . indoor standards."

In this connection, G.M. has an extensive "air cleaner" program under way, with dust suppressors on cupola (melting furnace) smokestacks of foundries. These keep dirt and obnoxious gases from escaping into the air from foundry stacks.

"From the toxicological viewpoint obviously the concentration of a contaminant that may be encountered up to 24 hr per day must be considerably less than one encountered only during a work day," Mr. Patty said. "But out-of-door contamination is largely offensive to taste, sight or odor sense rather than demonstrably injurious to health.

"The fastidious person might complain about a hazy atmosphere or a slight odor from some industrial operation and seek air that compares with country air, whereas his neighbor might be immune to the haze or odor and prefer to live near the plant that is offensive to the first person."

Mr. Patty added that because so little is known about outdoor air pollution, benchmarks or standards should cover only local areas, until enough data are collected to justify national standards.

THE SHOEMAKER'S CHILDREN

SOME RECENT trouble with expansion valves sticking on a low temperature refrigeration installation was traced to wax separation from the lubricating oil, a fellow we know told us the other day. The problem seemed particularly annoying, for the installation is part of the research facilities of one of the world's largest oil refineries.

RAY C. CONKLE, chief engineer of the Commodore hotel, Cleveland, describes the automatic damper controls for his two oil fired boilers which reduced fuel oil consumption from 96,411 gal during the first four months of 1948 to 79,360 gal for the first four months of 1949

Automatic Damper Controls Save Oil

CLEVELAND'S Commodore hotel, at Euclid Ave. and Ford Dr., is a 12 story stone and brick building, erected in 1924, which has 212 suites, a good-sized lobby, restaurant, lounge room, cocktail bar, etc. On the Euclid side there are nine stores and shops, all supplied with heat and hot water from the hotel boilers. The heating system has a total of 30,000 sq ft of radiation.

Our boiler equipment consists of two 100 hp steel firebox boilers, each of which is equipped with hot water coils for supplying service hot water. In moderately cold weather, one boiler has sufficient capacity for both our hot water and steam loads, and the second boiler is used in extremely cold weather.

Rotary type oil burners were installed in 1946. We found that because of our long suction lines, the heaviest oil we could use successfully was No. 4. After the first season, we installed oil preheaters, to enable us to burn the less expensive No. 5 fuel oil. This was definitely a step in the right direction.

But burning oil presented another problem. Our stack is 150 ft high. When we burned coal, we found that we could utilize most of the draft created by the high stack. With oil we felt that an unnecessarily large amount of heat was lost by excessive stack draft. Obviously, higher efficiency could be achieved if this draft could be automatically controlled during firing periods, and completely shut off during non-firing periods.

After considerable investigation of available equipment, we installed two time delay electric damper controls, one on each boiler. They represented an investment of under $1000, and were placed in service late in 1948. The accompanying table shows the results, in fuel saved, during the first four months of 1949, as compared with 1948.

As indicated in the table, the fuel oil used during the first four months of 1948 (with an average temperature of 35 F) totalled 96,411 gal, and in the first four months of 1949 (average temperature 34.6 F) the figure was 79,360 gal. This was a saving of 17,051 gal or about $1700.

Since there was a difference of only 0.4 F in average outdoor temperature between 1948 and 1949, the figures represent a definite improvement in efficiency—the net saving amounting to 17.7 percent for the four-month period. As a matter of fact, although higher 1949 temperatures favored the first two months, a saving of 4261 gal in March was made in spite of the

Close-up of electric drive unit for opening and closing dampers. There is one of these units for each of the two boilers

Fuel consumption first four months of 1948 and 1949

Month	Year	Gal. of Oil	Ave. Temp.*
January	1948	31,789	20°
	1949	23,380	29°
		8,409 less	9° higher
February	1948	27,714	28.6°
	1949	20,980	30.0°
		6,734 less	1.4° higher
March	1948	24,581	38.9°
	1949	20,320	35.6°
		4,261 less	3.3 lower
April	1948	12,327	52.6°
	1949	14,680	44.0°
		2,353 more	8.4 lower

*From readings taken at 8 a.m. daily.

The author points to the removable plug-in relays inside the automatic draft control unit

temperature averaging 3.3 F lower.

The damper control units are mounted on our regular boiler control panel on the wall in the boiler room, and are correlated with our conventional boiler controls.

At the top of each control is a fitting connected to a pipe line which enters the boiler and provides a constant sample of the overfire draft to the control diaphragm. This diaphragm automatically adjusts the damper to required settings during the firing periods—regardless of stack draft conditions. Since the automatic draft regulator is adjustable, we were able to select the setting which produced the best results. After several days of experimentation, we found that a reading of 0.08 in. of water over the fire gave us the highest boiler efficiency. Now we are assured at all times of the ideal draft for proper combustion and removal of flue gas—with a minimum of heat loss through our stack. Because draft can be held constant, our burners now require considerably less adjusting.

With these controls we have the added advantage of completely closed dampers during the "off" periods of burners when no draft is required, thereby preventing residual heat in refractory walls and boiler tubes from escaping up the stack. This has increased our "off" periods by as much as 5 min. Moreover, since there is still some heat in the system when firing starts, less time is required to generate steam and "on" periods are shortened—another saving.

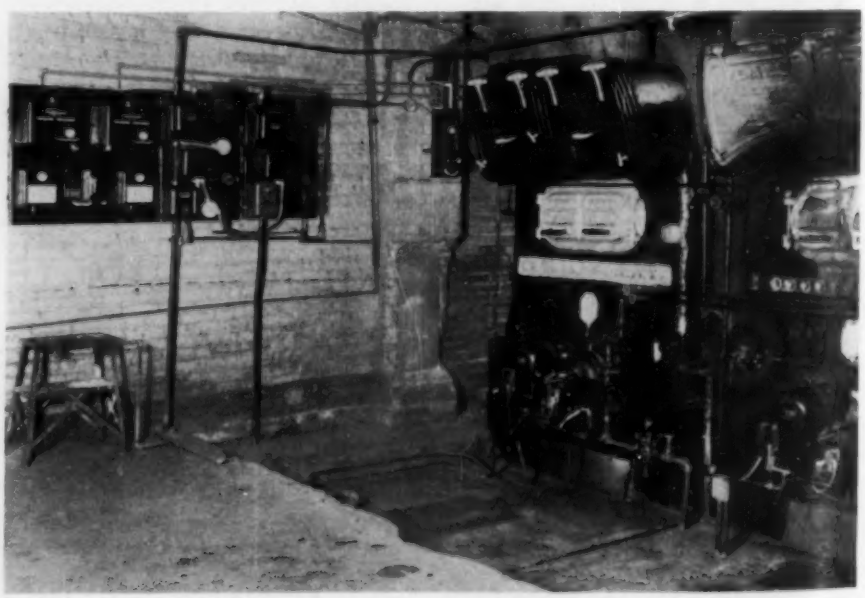
Three time delay relays control this phase of the operation. When the system calls for firing, relay No. 1 opens the damper by activating an electric piston-type worm gear drive unit. Relay No. 2 waits for the signal that the damper is full open, then starts the burner ignition. No. 3 waits for the signal that the flame is firmly established, then places the damper on automatic control, using signals from overfire draft as described above. When the demand for steam is satisfied and the burner shuts off, relay No. 3 closes the damper with the same electric piston-type worm gear drive unit, which is reciprocating.

We are, of course, vitally concerned with safety and are confident that these controls have improved the safety of our boiler operations. It is now impossible for the burners to ignite before the dampers have swung wide open. The time lag between the start of damper opening and burner ignition is not limited to a specific interval but is determined solely by the actual movement of the damper to full open position. We also have the assurance that in case of flame failure at any time during the heating cycle, the damper will automatically go to the full open position and remain open until the flame is re-established.

As an added precaution, our controls are designed to shut off the burner if the "selector switch" is moved from the "automatic" position during the firing period. This selector switch enables us to keep the dampers full open or full closed if for any reason we need to take the system off modulated draft control. There is also an emergency cutout switch which makes it possible instantly to cut out all control and return to manual operation of dampers.

With these controls we feel that we are making the best possible use of our present equipment. Our boiler operations are now completely automatic, efficient and safe.

The boiler room of the hotel, showing the two 100 hp steel firebox boilers. The damper control panel is at the extreme left



SAM LEWIS' PAGE

MAY PAY TO FORGET CONVENTION IN PIPING DESIGN FOR HEATING

RATHER interesting things can happen when one uses forced circulation hot water heating, especially if one can forget convention and thus emulate to some extent the patron saint of heating and ventilating engineers, Benjamin Franklin.

For example, the conventional approach to designing the piping and direct radiation heating of a large symmetrical school building might be to place radiators below the windows, and to serve them through vertical risers from horizontal flow and return mains running around the basement close to the ceiling and near the outside walls. These mains are by no means beautiful, since usually they must cross in front of all the basement windows. If the basement rooms are employed for useful purposes, the mains—even though insulated—tend to overheat them and in any case the heat from the mains cannot be shut off, as by a radiator valve.

The risers to serve the second story are objectionable where they pass through the first story. If there is no basement (a common modern economy) there may be pipe tunnels, which are costly, inaccessible, and hard to clean. Sometimes (through exceedingly mistaken judgment) the mains might be buried under the floor.

INFORMAL comment on heating, piping, and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, member of HPAC's board of consulting and contributing editors

Mains at Corridor Ceiling

In designing several large buildings where overhead radiant heating coils are partly embedded in the plaster, we have found it expedient to run separate horizontal flow and return mains at the ceiling of the corridor on each story. In such a design the main distribution is lateral rather than vertical, since the overhead coils in each room easily may be reached by short branches from the mains. All mains on all stories can be served by a single pair of risers in some recess along the corridor walls. The unsightly appearance and considerable labor inherent to many small risers along the outside walls are avoided. The scheme has been proved to work admirably.

When hot water heating is used in buildings like schools that have large rooms and many windows, there is no need (in my experience) for a separate conventional radiator under each window and but one thermostatic control valve per room will be necessary if the radiators in each room can all be connected to a single branch limited to that room.

Applying this experience and using modern gilled or finned radiators, it is practicable to extend a continuous heating surface, like a warm baseboard, all of the way around the exposed sides of a large room—such as a corner classroom that may be 24 ft by 30 ft in floor plan. The flow and return mains in a two or three story building might be above the corridor ceiling of any story, serving all of the rooms on all floors.

The continuous radiator, which may or may not be behind a protective grille, runs out and around far enough to do the job, and either the flow pipe or the return pipe connects back all the way, under the radiator and above the floor. This return may be 1½ in. or 1¼ in. plain pipe, depending on the duty. The gilled pipe may be 2 in. or 1¼ in. The combination has been found potent enough to heat most corner classrooms even in the coldest weather.

Reduces the Investment Cost

A heating plant designed on this principle effects a reduction in investment cost because a large proportion of the piping is heating surface beyond the thermostatic control valve and in consequence requires no insulation. The stretched-out heat transmission surface in each room tends to reduce air currents that are inclined to deposit dust.

Only one set of shutoff valves and one air valve per room are required with this scheme. The heat is distributed all along the cold walls and counteracts the cool downdraft air currents that frequently are evident near an unprotected window.

OFFICE BUILDING BOOM IN MANHATTAN

EIGHT MAJOR buildings nearing completion in Manhattan will provide approximately 3,628,000 sq ft of new office space, most of it in the Grand Central area, a survey by the Building Trades Employers' Association reveals. Another building, completed last January, has 170,000 sq ft.

Construction plans have been announced for five more major buildings to be completed by the end of 1950 or early in 1951. They will provide an additional 1,065,000 sq ft of rentable area.

Split System Heats Modern School

Convectors, Floor Heating Are Combined;

Perimeter Pipe Trench Cuts Heat Losses

AN UNUSUAL "split" system of heating, which assures maximum comfort for children in the classroom, features the newly-completed Clyde L. Lyon elementary school in Glenview, Ill.

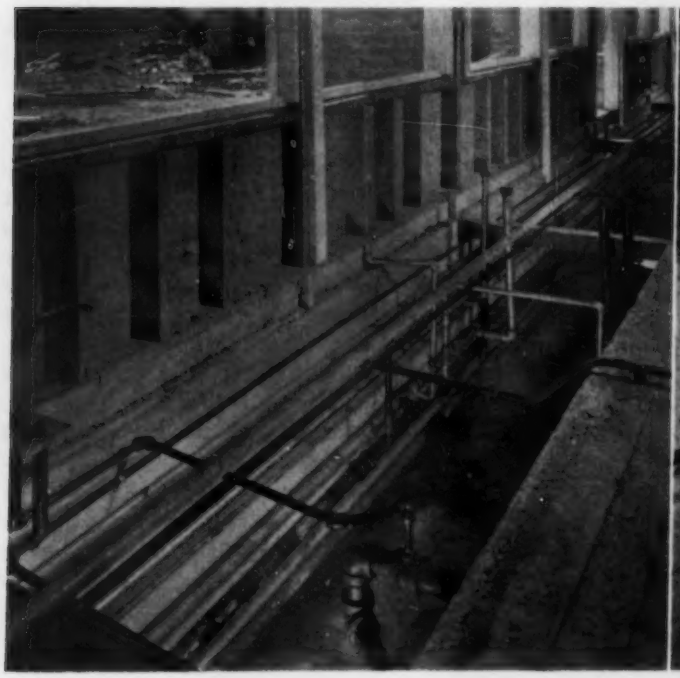
Its one story construction allows for economical future expansion from the present 10 to 16 classrooms. The design utilizes advanced architectural features to assure the health and comfort of its pupils, and its functionalism was achieved without sacrificing beauty of exterior and interior design.

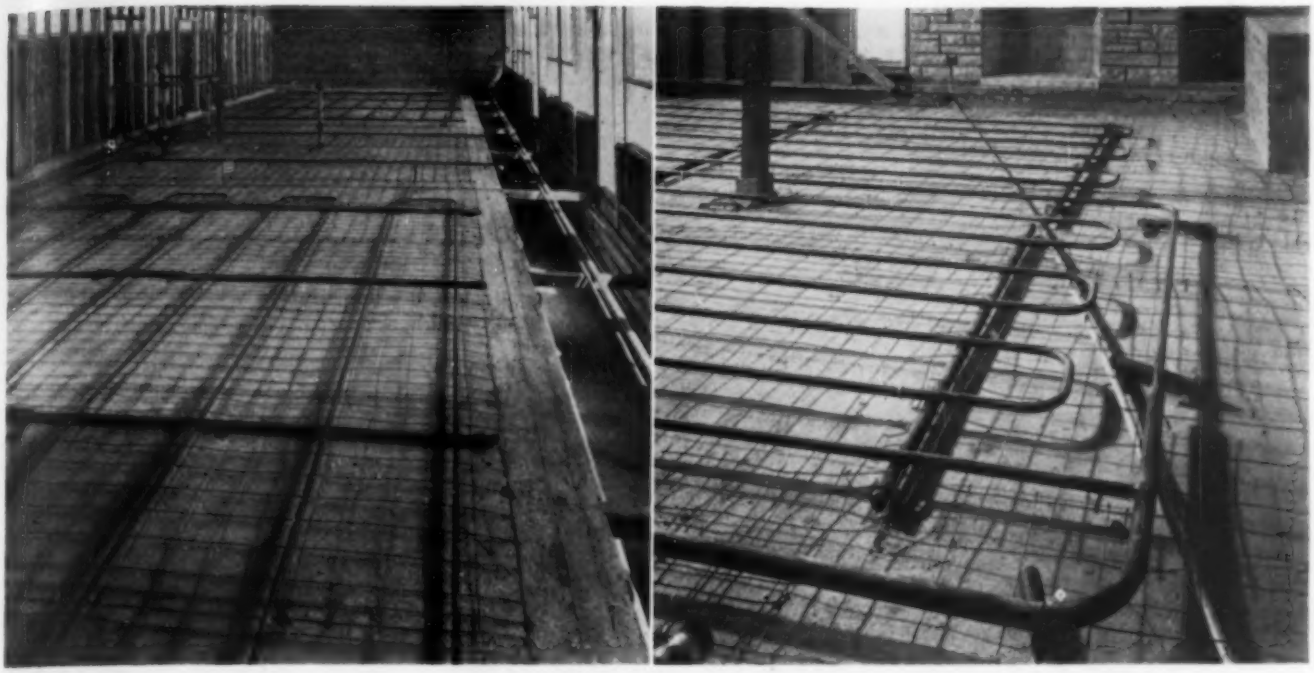
The heating system was developed by E. R. Gritschke, consulting engineer, Chicago, in collaboration with Perkins & Will, architects-engineers, who designed the school.

With the split system, the convection heating carries the major share of the load, while the floor radiant system insures against cold floors—one drawback of the one story type of schoolhouse construction. The floor radiant system, which responds to temperature changes relatively slowly, is controlled by outdoor thermostats, while interior thermostats control the quickly responding convectors.

Heat losses of the floor system are minimized through concentration of all mechanical supplies in a perimeter trench running the

Detailed construction photos of perimeter utility tunnel showing passage under interior partition and orderly grouping of four basic service elements: (a) electrical conduit at top, center, to be buried in slab; (b) piping for hot and cold water supply for toilets and workrooms against outer wall; (c) radiant floor coil piping against outer wall, and (d) convector-radiator piping along inside wall. Note careful architectural detailing for proper support and sleeving of convector leads for exact location and rapid installation of convectors





Left—**A perimeter mechanical tunnel facilitates installation, testing and maintenance and serves as a barrier to the excessive heat losses from the floor heating in many floor radiant heating systems. Note the utility tunnel to the right and the relatively wide spacing of the floor coils in the intermediate classroom wings.** *Right*—**In the kindergarten wing, where children frequently play on the large floor area and better control of the floor temperature is essential, the coils are spaced more closely. The main to the right is split to supply the two coil systems in the floor**

length of the outer walls of the classrooms. Roofed over after installation, this tunnel is an effective barrier against moisture and cold and facilitates easy installation, testing and maintenance of the mechanical services. This design contributed to a minimum installation cost for the heating system.

The architects made full use of color, sunlight and space in the design of the school. Cheerful classroom illumination is gained through the clerestory windows on the western exposure, and the full glass windows, punctuated by the closely spaced jib walls, to the east.

A "homey" atmosphere is heightened by the warm-toned brick partitions between classrooms, and the natural Ponderosa pine walls. These walls serve a dual purpose, making a colorful and convenient display area for artwork, maps and modern visual teaching aids in the classrooms, corridors, community lounge and playroom.

In keeping with Glenview's system of a progressive "activity" type of educational program, each classroom has its own adjoining workroom, separated by a glass partition so teachers can watch individual and group activities while working with the larger classroom group.

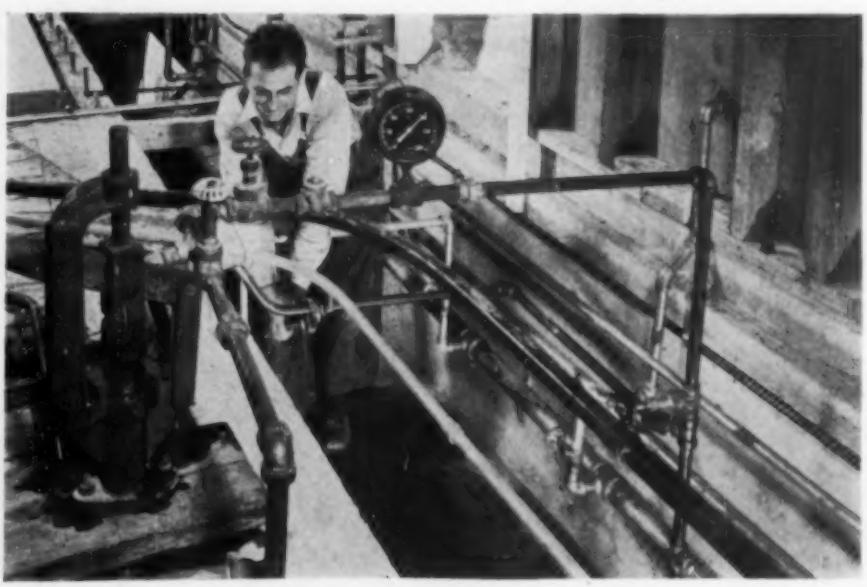
Common facilities for both the school children during the daytime and for the adult community at night are concentrated in the central "community" unit. This includes a cheery playroom with walls of glass and brick; a community lounge with a multitude of functions; the library; a health services room; the administrative suite; and, in the basement, a combined visual aids room and the school cafeteria.

Although the school was built during a period of peak building costs and material shortages, total cost of the building, excluding architects' fees, was $367,924, or $12.43 per sq ft.

Subcontractor for the heating and plumbing was the Northern Plumbing and Heating Co.

[Photos by Hedrich-Blessing]

Steamfitter completes installation of gage and pump for 200 lb hydrostatic test of the completed floor radiant coil heating system. A 200 lb pressure was maintained on the system while concrete was being poured as insurance against damage, leaking, etc.



Today's Pipe Welding Practices

F. C. FANTZ, vice president, Midwest Piping & Supply Co., Inc., has played an important part in the growth of welding from its original status as a repair tool to its present position as a basic method of piping fabrication and installation. His discussion of pipe welding practices as used today includes numerous practical and valuable suggestions

IN SELECTING pipe connections to accomplish a change in direction of the line, the designing engineer has a choice of the three basic types in Fig. 13: Pipe bends (A); elbows —either welding, flanged or screwed, as in (B), (C) and (D); and miter-welded elbows (E), commonly called "stovepipe" assemblies.

Directional Changes in Piping

The first two types of directional changes are comparable in many ways. The third type, the miter-welded elbow, is not recommended except in emergency installations: flow conditions in these segmental assemblies are very poor; the difficulty of welding usually leads to uneven contours and icicles on the inside of the weld; and the cost of such a connection, if made with two welds, is higher than that of the other two types.

Pipe bends are generally made to a radius equal to five times the nominal pipe diameter. It is obvious that flow conditions in a pipe bend would, therefore, be better than in any type of elbow, since the latter are invariably formed to a much smaller radius. Consequently, it is safe to say that if other considerations may be eliminated, pipe bends should be used in place of either welded or flanged elbows. The fitting assembly, however, has advantages from the standpoint of space economy, and, since the fittings are usually carried in local stocks, the additional advantage of immediate availability. Accordingly, in practical application piping will often include a combination of pipe bends and elbows, each used where its application best serves the purpose of designing and constructing engineers.

There is often a question in the minds of piping engineers as to the relative flexibility of bends and elbows. Tests in our laboratory have shown that the flexibility of these two assemblies would be practically identical, given the same amount of pipe in each. Consequently, if fabricated with the same center-to-end dimension, the fitting assembly will contain more pipe, and provide somewhat greater flexibility than the bend. However, the shape and structure of the elbow is such that we cannot expect appreciable flexibility in the fitting itself. Our conclusions, based upon actual experiments, are that the elbow offers no greater flexure than a straight piece

Fig. 13—Pipe bends (A); welded, flanged or screwed elbows (B,C,D); or miter welded elbows (E) may be used for directional changes in piping

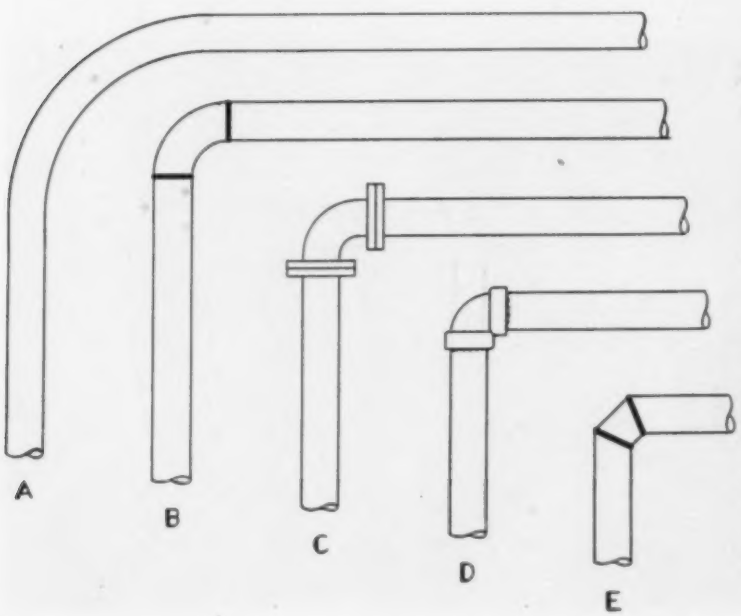
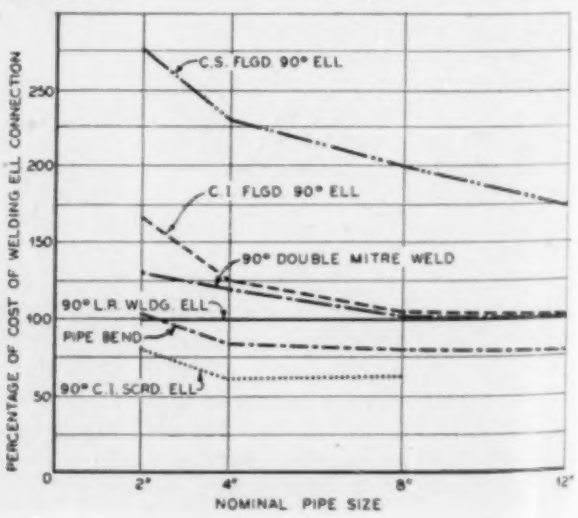


Fig. 14—Relative costs of 90 deg pipe connections, the welding elbow assembly being assumed as 100. Costs include all necessary materials (pipe, fittings, companion flanges bolts, gaskets, welding rod), labor (cutting, bevelling or threading, welding or making-on, flange bolting), and a sufficient amount of pipe to make all assemblies comparable in center-to-end dimensions



of pipe equivalent in length to the center-to-end dimension of the fitting.

In a 90 deg connection made with a flanged elbow, almost absolute rigidity exists in the fitting, subjecting the flange and the adjacent pipe to high stress concentration. This, combined with the inability of the bolted joint to withstand torsional forces, causes numerous gasket failures and leaks.

Let us glance briefly at the relative costs of these 90 deg connections. (Fig. 14). It might be of interest to point out that the cost of a shop-made bend is closely comparable to the cost of a 90 deg welding elbow assembly (including the amount of pipe necessary for identical center-to-end dimensions). The cost of a flanged elbow assembly of comparable strength, however, is considerably greater than either of the two other types. The relative costs shown in this graph are subject to the same reservations described previously in comparing costs of flanged connections; they will vary from place to place and from job to job, and the comparison is intended only as a rough guide.

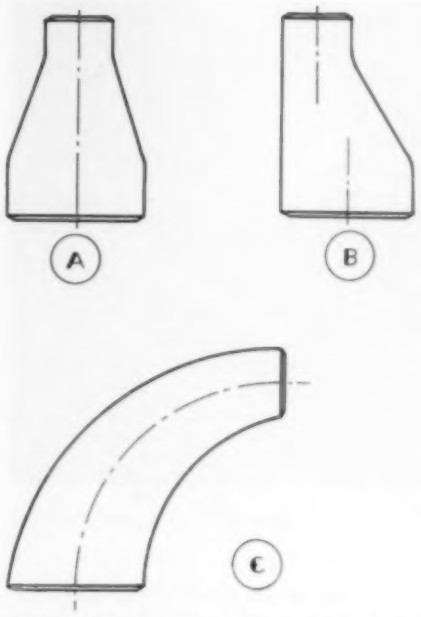


Fig. 15—Reduction in line area is generally accomplished with reducing fittings—A, concentric; B, eccentric; C, reducing elbow

Reduction in Line Area

At many points in a piping system, it becomes necessary to reduce the size of the line. This is generally accomplished by the use of reducing fittings, either concentric or eccentric with the center of the line (Fig. 15). The eccentric reducer (B) is primarily used to eliminate pockets in horizontal lines such as drains, bleeders, etc. It should be realized that the eccentric reducer tends to produce an unequal stress condition in the line when subjected to expansion and contraction; this, added to increased cost of the eccentric fitting, would indicate the use of concentric reducers (A) wherever possible.

As there are generally turns in a line at points where reduction of area is required, a reducing elbow is often employed to accomplish both purposes, and at the same time, to improve flow conditions and reduce cost. Reducing elbows such as the one in Fig. 15C are available as stock fittings in sizes from 2 to 12 in. and in reductions to one-half size (e.g., 4 in. reducing ells are carried in sizes 4 x 3½ in., 4 x 3 in., 4 x 2½ in. and 4 x 2 in.).

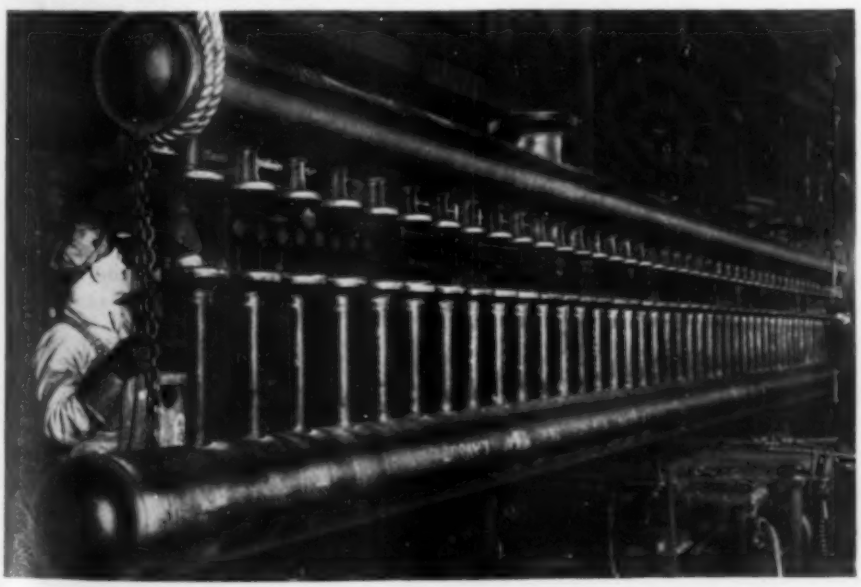
Diversion or Separation of Flow

When we come to a diversion of flow or separation of the line into two or more branches, we have several choices of connections: flanged or welding tees, headers or manifolds with welded nozzle connections; and especially formed and welded assemblies such as those shown in previous photographs.

When there is a considerable distance between branch connections, it is generally deemed best to use welding tees. Where several openings can be placed in one length of pipe, it is usually better to fabricate a header with welded nozzles. A very good example of this is shown in Fig. 16. We might say that it requires considerable experience, as well as carefully developed layout and welding techniques, to produce headers of this type. All flange faces must be on the same level and exactly spaced.

In Fig. 17 is shown another example of what can be done in designing for both compactness and flexibility. These headers were fabricated for an oil refining process operating at 1500 psi and 600 F. Note that all flanges are machined with large tongue-and-groove facing. It is difficult to imagine the appearance of these headers and the space that would be required had they been made from flanged fittings.

Fig. 16—Good example of a header with welded nozzles. It requires a carefully developed layout and welding technique



Nozzle Reinforcement

In considering the reinforcement of a welded nozzle or branch connection, we should realize that our problem is actually the restoration, rather than the addition, of strength. In any nozzle connection, the attachment of a welded branch destroys the circular cross-section of the header and replaces that section with a contour having greatly reduced powers of resistance to internal pressure. This weakness is particularly noticeable in the area marked "X" in detail (A) of Fig. 18.

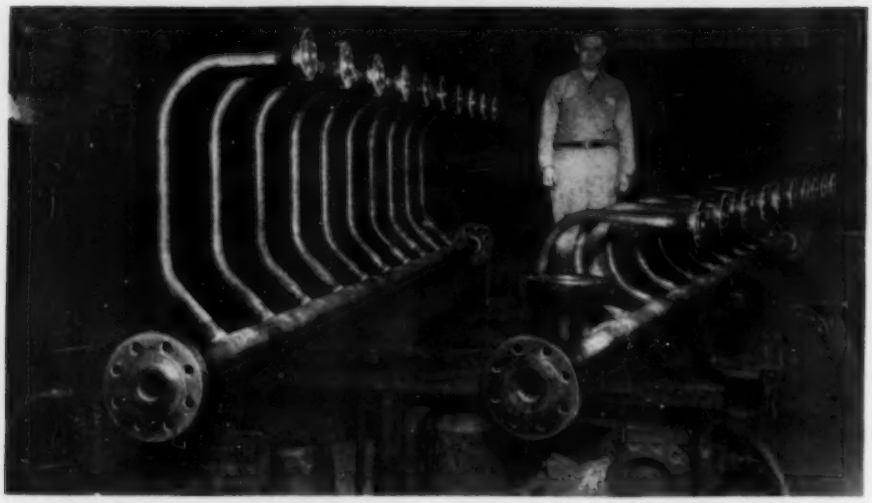


Fig. 17—Another example of what can be done in designing for compactness and flexibility

Unfortunately, laboratory study of the welded nozzle has not progressed sufficiently to provide a basis for a rational mathematical formula to compute replacement needs. The Code for Pressure Piping (like the Boiler Code and the Unfired Pressure Vessel Code) must therefore proceed on empirical assumptions. The code states that the cross-sectional area of the metal removed from the header (taken parallel to its centerline) must be compensated for by an equal area of replacement metal. The stiffening effect of the nozzle itself is allowed for; additional strength needs are generally provided by one of four methods:

1) The use of a saddle type reinforcement.

2) The application of a welded reinforcing ring.

3) The addition of supplementary deposits of metal to the fillet weld.

4) The use of a welding tee, which is designed to provide full strength.

In addition to these methods, nozzles are sometimes strengthened by increasing the wall thickness of the header or of the nozzle, or of both.

The welding saddle shown in detail (B) of Fig. 18 not only reinforces the header section to compensate for the metal cut away, but also supports the flat section of the branch shown at point "X". In addition, the neck of the saddle extends for some distance above the header pipe before being welded to the branch. Therefore, the stresses set up by flexing of the branch line are distributed away from the crucial weld joining the branch and the header.

The ring type reinforcement, detail (C), will adequately strengthen the header itself, but does not take care of the critical portion of the nozzle at point "X". Nor does it contribute to minimizing the effect of the flexing stresses.

Note that regardless of the replacement method used, we are primarily concerned with compensating for the strength lost by cutting into the header pipe. Any reinforcement applied beyond this replacement need is superfluous.

In this connection, we might state a general principle in piping design. The engineer determining the method of header reinforcement has the choice of two alternatives: first, to make the reinforcement so heavy that no movement can take place in the vicinity of the junction; and, second, to design the reinforcement so that the entire section is flexible to a certain degree. In the first case, he is faced with the necessity of graduating the heavy structure to the normal condition of the pipe line in order to prevent concentration of stresses. In the second case, the structure is prepared so that it will adjust itself to the operating conditions.

I would very much prefer the latter method; as a matter of fact, in my opinion, the entire piping system should be designed to allow its adjustment to operating conditions. I have seen many a bend and header, removed from the line after a period of successful operation, changed materially from the original dimensions due to improper flexibility calculations.

It is important to note that neither the saddle nor the ring type reinforcement should be considered as a pressure member; in fact, a hole should be drilled through the ring or saddle to relieve the pressure of gases during the welding operation. In addition, this vent will serve to accommodate expansion of the air or gas between the reinforcement and the piping during operation of the line at high temperature.

We have learned the necessity of these vents through sorry experience. Many years ago, we fabricated headers equipped with ventless saddles and ring reinforce-

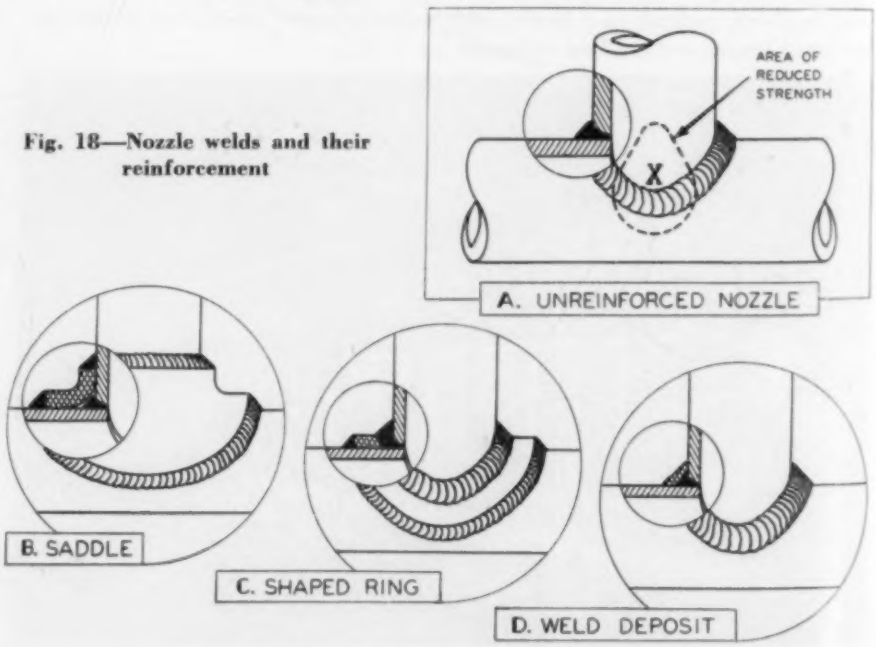


Fig. 18—Nozzle welds and their reinforcement

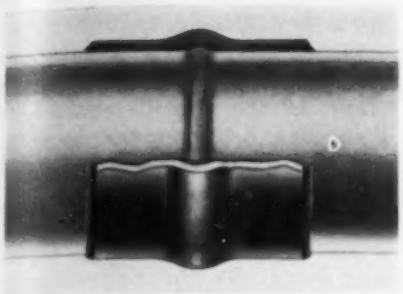


Fig. 19—Welding sleeve as used to distribute the excess stress away from the welded joint

ments, following which the assemblies were placed in the heat treating furnace and brought to 1600 F. When they were removed and cooled, it was found that the pipe had bulged inward due to the expansion of gases in the air space between the reinforcement and the pipe. This same condition would certainly appear to a lesser degree in operation.

It is generally considered that where the branch connection is one-quarter the size of the header (i.e., a 3 in. branch on a 12 in. header), or less, very little reinforcement is necessary. In such cases, the necessary strength can be provided by increasing the amount of deposited weld metal, as shown in detail (D) of Fig. 18.

Butt Weld Reinforcement

We are frequently asked, "Should a butt weld in a pipe line be reinforced?" We have stated before our conviction that two pieces of pipe joined properly by welding will have physical properties equal or superior to the parts joined. There are, however, conditions where it seems advisable to reinforce the butt weld for other reasons. For example: in pipe lines laid in river beds, or in places where we are likely to encounter sudden and violent distortion in the position of the pipe from such natural causes as landslides or washouts, it may be preferable to apply additional reinforcement to the butt weld. In such cases, welding sleeves as shown in Fig. 19 have been used to distribute the excess stress away from the welded joint. In the application of the sleeve it is customary to make a full strength weld between the two halves of the sleeve and, in addition, circumferentially around each end of the sleeve. Unquestionably, the strength weld between the two halves is necessary; however, if the sleeves are properly fitted, these longitudinal welds will make a shrink-fit on the pipe, and should eliminate the necessity of any weld between the ends of the sleeves and the pipe.

Note that a welding sleeve, like a welding saddle, should not be considered a pressure member. Rather than use the sleeve to seal a defective weld, precaution should be taken to insure that the butt weld will be properly made, so that no pressure seal is necessary. Similarly, the sleeve should not be applied as a strength member to hold the two sections of pipe together. This is properly the function of the butt weld alone.

Welding Procedures

Let us refer again to the statement that with proper procedures and supervision, welded joints are equal in strength to the parent metal. In order to accomplish this, tried and proved welding processes are a "must". The various codes have set up certain minimum requirements for various types of pipe welding. It will not be amiss to quote here from the ASA Code for Pressure Piping (B31.1) which states: "Each manufacturer or contractor shall be responsible for the quality of the welding done by his organization, and shall conduct tests not only of the welding procedure . . . but also of the welding operators. . . . It is assumed that the manufacturer or contractor performing the welding has an organization familiar with this code and capable of designing, engineering and supervising welded piping constructions." Note the emphasis on the necessity that all members of the organization be familiar with welding, and capable in performance.

[This is the second of three articles on this subject by Mr. Fantz. The first appeared in the November HPAC.]

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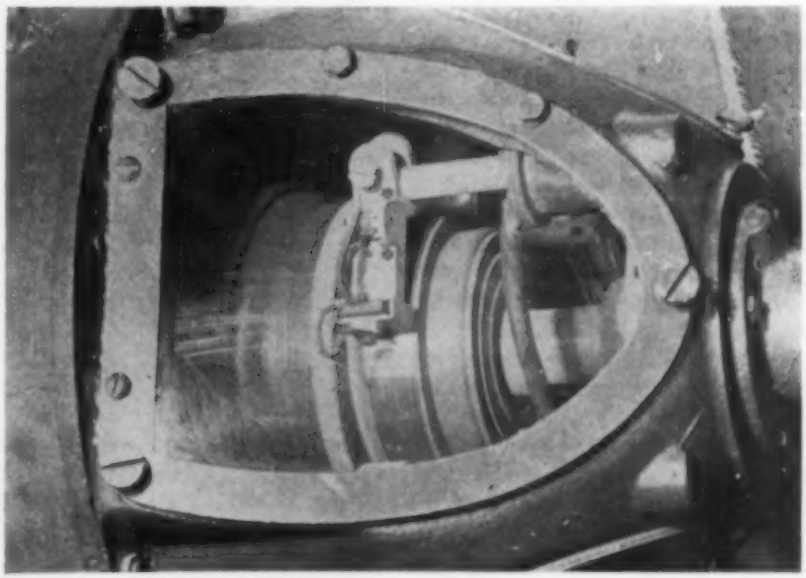
• *A few hundred copies of the Snow Melting Manual—a collection of articles which have appeared in HPAC—are available (while the supply lasts) to HPAC subscribers only upon request to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.*

Gold Fish Bowl for Motors

INSPECTION TIP—At the New Beach plant of the Nekoosa-Edwards Paper Co., in Wisconsin, the motors are given little privacy. The steel inspection plates have been replaced with 3/16 in. Plexiglass, permitting visual inspection of brushes and commutator at all times (photo courtesy Westinghouse Electric Corp.)



NO MORE "HOT HEADS, COLD FEET"

Air Conditioning the New House of Commons

J. R. KELL, partner, Oscar Faber & Partners, consulting engineers, London, describes the air conditioning of the new House of Commons, which forms a part of the palace of Westminster. An unusual feature is the control. The operating engineer stationed in the main control room to anticipate sudden changes in occupancy in the debating chamber will have a periscope through which to view the chamber and a loudspeaker

THE HOUSE of Commons forms part of the palace of Westminster, and lies between the central lobby and the great clock tower known as Big Ben. The original palace was damaged by fire in 1512 and was completely burned down in 1834. In the years immediately following, the present familiar structure was erected to the designs of Sir Charles Barry, in the perpendicular gothic style.

The debating chamber of the House of Commons, together with the lobbies and a good deal of the surrounding accommodation, was entirely destroyed during an air raid in 1941.

Even before the end of the war, the government had planned to rebuild, and it may be said that this is one of the first major works of reconstruction to be undertaken. The ministry of works appointed as architect Sir Giles Gilbert Scott, and the consulting engineer for the mechanical, electrical and structural engineering work is Dr. Oscar Faber.

The layout of the new building follows broadly that of its predecessor, but the application of air conditioning has made it possible to provide a great deal of much-needed extra accommodation in spaces which were previously useless. For instance, two extra floors of offices and conference rooms are now provided under the chamber, and another floor above it. In the planning of the chamber, the architect has contrived to increase considerably accommodations in the galleries for public and press.

The ventilation of the old chamber had never proved satisfactory, as is evidenced by the numerous royal commissions, committees and experts who were appointed from time to time to examine and report. The history of the complaints and the suggested remedies are too long to go into here, but it is strange that in spite of much good advice, little was done over a hundred years by way of improvement —indeed, the main features remained the same as at the beginning.

The system as it existed in 1941 consisted of an outdoor air intake on the river terrace, whence the air passed through a rudimentary bank of water sprays and along a tiled passage to a large cased fan in the vaults under the chamber. The fan delivered the air over steam heated coils and through a "fog filter" made up of loose cotton wool about 4 in. thick. This filter was bypassed except during foggy weather on account of the much reduced air flow which it caused. From the vaults, the air passed through gratings in the floor of the chamber, which were covered with open mesh matting. A second fan in the roof space provided the exhaust.

With this system large quantities of air were introduced. It suffered from the inherent defects associated with delivering air over the feet and thereby cooling them, and at the same time lifting the dust and dirt from the floor into the atmosphere to be breathed. It was said that the conditions favored hot heads and cold feet, a state not altogether desirable for a body of legislators!

In the new House it has been decided to introduce the air horizontally above head level under the gallery and under the roof, and to exhaust it near the center of the ceiling and also from near the floor. To minimize the danger of drafts, the inlet velocities have been kept low, and in addition the ducting has been so arranged that the air can be blown in alternately from one side for a predetermined period, and then from the other side for a similar period. The direction and strength of the air movement will thus be continually changing, with the object of inducing a sensation of freshness in all parts of the chamber.

The seating capacity of the chamber is nearly a thousand persons, of whom approximately one-third are members sitting on the "floor" of the House and the remainder are press reporters, distinguished visitors, and the public, in the various galleries. It is a curious anomaly that in the House of Commons there has never been one seat per member, and in the new chamber this feature is continued, preserving the intimate character of the debates, which in general are attended by only a small proportion of the members.

Two air conditioning plants are provided for the chamber, one for the floor and one for the galleries. Six other plants deal with the offices and conference rooms, press accommodations, and other departments associated with the working of the House.

Each plant consists of a viscous air filter followed by an electrostatic air filter, a finned tube air cooler for sensible cooling or dehumidification, followed by glass eliminator plates, and then, in order, a finned tube heater battery and humidifying sprays. The various components are housed in a

brickwork casing the inside of which is tiled for ease of cleaning. The fan for each plant is placed upstream or downstream as convenient. A steam heater battery is provided in each of the outdoor air intakes to preheat the air in abnormally cold weather.

The heating medium for the main heater batteries is hot water at about 180 F flow. For the cooler batteries, calcium chloride brine is used, leaving the refrigeration plant at a temperature of about 28 F. The latter comprises two reciprocating compressors using "Freon-12." The brine is stored in a large cylinder to act as a cushion to smooth out the fluctuating requirements of the various plants. The condenser water will be cooled by atmospheric forced draft coolers in one of the roof spaces.

In the important matter of controls, several unusual factors presented themselves. Apart from the day-to-day vagaries of the climate, there is a rapid and unpredictable variation in occupancy of the chamber; at one time there may be an attendance of only 20 or 30 members, while in the space of a few minutes this may be increased to two or three hundred, should some important debate commence. Or again, the members may leave the chamber entirely for a "division" but the galleries may remain filled.

There is the further complication that some of the members may have been in the chamber for several hours, while others have just entered and will not be acclimated to the atmospheric conditions. Purely automatic controls, which react only *after* the conditions have commenced to vary, were not considered to present a complete solution to the problem, and it was therefore decided to centralize all the plant controls in one main control room, manned by an engineer, and to give him a large measure of manual control over the operation of the plants.

The intention is that he will be able to *anticipate* sudden changes in occupancy within the chamber, by setting the controls accordingly. For his better guidance a periscope is provided through which he can view the chamber, also a loudspeaker relaying the proceedings to the control room.

The controls are electrically operated, and each item of the plant, such as the heater, cooler, etc. has its own controller normaliy set at "automatic," but capable of being inched open or closed to any desired extent, and left in that position, thus over-riding the normal demands of the control system.

In addition, the operating level of the control system as a whole is reset automatically so as to limit the differential between inside and outside during the cooling period.

Further controls enable the engineer to vary the volume of air delivered to the chamber, and to reset the temperature range to some higher or lower level. During an all-night session, for instance, it has been found that a higher temperature is desirable—due, no doubt, to the lower metabolism of the human body in the small hours.

The offices and conference rooms presented a different problem. Any one of these numerous rooms may be filled to capacity for a time, while others remain but sparsely occupied. A plant of the double duct type has been provided, one duct supplying cool and the other warmer air. Each room has a blender so that any proportion of air can be taken from either duct according to occupancy or other heat gain.

The various other plants also have special and interesting features determined by the particular requirements to be met.

It is anticipated that the rebuilding will be completed in the spring of 1950, and after tests have been run, it is hoped that it will be possible to present to one of the engineering institutions a paper giving technical data on the design of the air conditioning, heating and other mechanical and electrical services.

View from a model of the new debating chamber of the House of Commons, which is being rebuilt after being destroyed during an air raid in 1941. After hundreds of years of unsatisfactory ventilation, the new chamber will be air conditioned

How to S-p-a-c-e

PIPE SUPPORTS

THE THIRD and fourth formulas used in constructing the chart, Fig. 1, for determining the maximum spacing of pipe supports, which was published on page 95 of the October issue, are used for calculating bending stress in fixed and free spans, respectively.

Development of Formula for Calculating Stress in Bare Empty Steel Pipe with Fixed Supports—The well known formula for bending stress in a beam is:

$$S = 6M\ D/I \quad \text{.....[59]}$$

where M is the bending moment, ft-lb. D is the mean diameter of the pipe, in. (Actually, D is usually taken as the outside diameter of the pipe in order to calculate the maximum stress at the outside fiber of the pipe. The bending stress calculated with the above formula is always later to be combined with other stresses including hoop tension and radial stress which are at a maximum at the inside fibers of the pipe. For that reason, it is considered as justifiable to use the mean diameter in the above formula as the calculation is simplified by so doing). I is the moment of inertia of the pipe cross section, in.^{4}

In equation 45, the bending moment for a fixed span was calculated as $M = W\ L'/12$. Substituting [45] into [59]:

$$S = W\ L\ 'D/2\ I \quad \text{.....[60]}$$

But, according to equations 10 and 11, $W = 3.4\ \pi\ D\ t$ and $I = \pi\ D^3\ t/8$.

Substituting [10] and [11] in [60], $S = 3.4\ \pi\ D^3\ t\ L'\ 8/2\ \pi\ D^3\ t$. Therefore:

$$S = 13.6\ L'/D \quad \text{.....[61]}$$

Equation 61 is the third equation used in constructing the alignment chart in Fig. 1. This formula is used for calculating the bending stress, S, in a bare empty steel pipe. The value obtained from the chart must be multiplied by the ratio of weights to obtain the actual bending stress in the pipe.

$$S'' = S\ W''/W \quad \text{.....[62]}$$
$$Sw = S\ W'/W \quad \text{.....[63]}$$

S'' is the actual bending stress resulting from the dead weight of the pipe (W'' lb per ft). Sw is the bending stress resulting from the wind load, W', acting on the pipe.

Development of Formula for Calculating Bending Stress in Bare Empty Steel Pipe Freely Supported—The maximum bending moment occurs in the middle of the span, where $X = 0$, as can be noted in Fig. 3 on page 96 of the October article.

Substituting $X = 0$ in equation 17:

$$M_{max} = W\ (L')^2/8 \quad \text{.....[64]}$$

Substituting [64] in [59]:

$$S = 0.75\ W\ (L')^2\ D/I \quad \text{.....[65]}$$

Substituting [10] and [11] in [65], $S = 0.75\ (L')^2\ D^2\ 3.4\ \pi\ t\ 8/\pi\ D^3\ t$. Therefore:

$$S = 20.4\ (L')^2/D \quad \text{.....[66]}$$

Equation 66 is the fourth and last formula used in constructing the alignment chart, Fig. 1. S, as obtained from the chart, must be corrected by the ratio of weights to obtain the actual stress.

$$S'' = S\ W''/W$$
$$Sw = S\ W'/W$$

Combining of Stresses in a Pipe—In the preceding paragraphs, the bending stresses in the pipe caused by the dead weight and by the wind loading were calculated. It now remains to combine these stresses with the other stresses which are found in a pipe. Before proceeding with the combining of the various stresses, the method used in calculating each of the several stresses will be very briefly reviewed.

It will be necessary first to calculate the other bending stress, St, caused by thermal expansion of the pipe. The actual calculation of this stress is not within the scope of this article except to note that it must be estimated for that point in the piping where the stresses S'' and Sw are at a maximum. Or, it may be necessary in some cases to figure the values of S'' and Sw at the point where St is at a maximum. It is usually possible to readily pick the point where the combined stress will be at a maximum, and that is the point that must be analyzed in detail.

Further, if horizontal expansion bends are employed, St will add

THEODORE E. BRIDGE, a mechanical engineer with the University of Chicago in connection with a project under construction for the Argonne National Laboratory, acquired a wide experience in the design of power and of process piping during 15 years with E. I. du Pont de Nemours & Co.; he has also had experience in the field of very high pressures. In his article (of which this is the third part) he presents a rational method for determining the spacing of pipe supports. The data are of particular value in those instances where it is desired to place the supports as far apart as possible. Little information on the matter is available elsewhere.

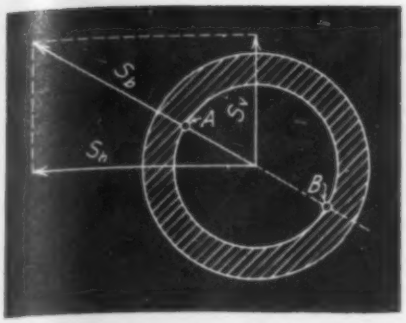


Fig. 10—Section through pipe at point of maximum bending moment. Two points of maximum stress are indicated, *A* and *B*. *Sh* is the horizontal component of the bending stress caused by wind load and thermal expansion, *Sv* is the vertical componet of the bending stress, and *Sb* is the resultant bending stress in the pipe

directly to *Sw* to give a total horizontal bending stress, $Sh = Sw + St$. If, on the other hand, vertical expansion bends are used, *St* will add directly to *S″* to give a total bending stress in the vertical plane, $Sv = S'' + St$.

In this connection it should be noted that the American Standards Association Code for Pressure Piping allows ⅓ reduction in the thermal expansion stress *St* to take credit for cold spring if applied. In this article, it will be assumed that the values given for *St* are net values after the credit for cold springing is taken. Also note that, at a road crossing, *St* may be considered as minus in the hot position and plus in the cold position when cold springing is applied. For fixed spans, the stress *St* will be considered as plus in both the hot and the cold position.

In some cases, the piping will be so formed that the thermal expansion stresses will have components in both the horizontal and the vertical planes. In such cases, the vertical component will add to *S″* and the horizontal component will add to *Sw*. In some cases there may also exist a twisting component which will be expressed as shear stress and will be called *T*. This problem will be further clarified by reference to the sample problems to be given later.

After having calculated the horizontal and vertical components of the bending stress, it is now possible to calculate the combined bending stress, *Sb*, by taking the vector sum of the two components.

$$Sb = \sqrt{Sv^2 + Sh^2} \quad \ldots\ldots\ldots [67]$$

The axial stress *Sa* caused by pressure in the piping is next calculated. This stress will be substantially zero if either slip or bellows type expansion joints are used; but if expansion bends are used, the following equation will apply:

$$Sa = P\,D'/4t \quad \ldots\ldots\ldots\ldots\ldots [68]$$

The hoop tension in the pipe caused by pressure may be calculated using the formula in the Code for Pressure Piping, ASA B 31.1, paragraph 423 a.

$$Sp = [P\,D''/2\,(t' - c)] - 0.4\,P \ldots [69]$$

In equations 68 and 69, *P* is the pressure in the pipe, psi; *D′* is the inside diameter of the pipe, in.; *D″* is the outside diameter of the pipe, in.; and *t′* is the minimum thickness of the wall of the pipe, in. Note that if ASTM A53 or A106 seamless pipe is used, $t' = 0.875\ t$, where *t* is the nominal thickness of the pipe. *c* is a corrosion allowance. For normal conditions, with plain end pipe larger than 1 in. diameter formed by welding, *c*, according to the piping code, is taken as 0.065.

If heavy wall pipe is used, where *t* is more than 10 percent of *D*, it is recommended that the Lamé formula be employed. [see page 239, Part II, Strength of Materials, by Timoshenko, 2nd edition, D. Van Nostrand, Inc.]. This formula allows for the considerable concentration of stress which occurs at the inside fibers of heavy wall pipe.

$$Sp = P\,(K^2 + 1)/(K^2 - 1) \ldots [70]$$

K = the ratio of the outside diameter of the pipe to the effective inside diameter = $D''/(D'' - 2t' + 2c)$

Finally, it is necessary to include in the analysis the radial stress in the pipe. It can be shown that the combined stress will usually be at a maximum at the inside fibers of the pipe and at this point, the radial stress,

$$Sr = P \quad \ldots\ldots\ldots\ldots\ldots [71]$$

After all of the above stresses have been figured, it remains only to combine them to obtain the total equivalent stress *Se*. The Code for Pressure Piping does not cover the combining of stress, but it is believed that the designer should make use of the latest theory available. The last word on combining stresses has not yet been written; but, at least for ductile materials such as steel, the evidence is very

SYMBOLS

- c = the corrosion allowance, in. (usually taken as 0.065).
- D = mean diameter of pipe, in. $D = D' + t$.
- D' = inside diameter of pipe, in.
- D'' = outside diameter of pipe, in.
- I = moment of inertia of pipe section, in.⁴
- K = ratio of outside to effective inside diameter. $K = D''/(D'' - 2t' + 2c)$.
- L = distance between fixed supports, ft.
- L' = distance between free supports, ft.
- M = bending moment, ft-lb.
- P = the design pressure of the fluid in the pipe, psi.
- S = bending stress, due to its own weight, in a bare empty steel pipe, psi.
- S'' = bending stress, due to the total weight of pipe, contents, and insulation, psi.
- Sa = axial stress caused by pressure in the pipe, psi.
- Sb = resultant bending stress in the pipe, psi. $Sb = \sqrt{Sv^2 + Sh^2}$
- Se = the equivalent stress obtained by combining all of the other stresses in the pipe according to the maximum shear theory (note that this is sometimes called the double shear stress), psi.
- Sh = the horizontal component of the bending stress, psi.
- Sp = the hoop tension in the pipe wall caused by pressure in the pipe, psi.
- Sr = the radial stress in the pipe wall caused by pressure in the pipe, psi.
- St = the bending stress caused by thermal expansion of the pipe, psi.
- Sv = the vertical component of the bending stress in the pipe, psi.
- Sw = bending stress due to wind load, psi
- T = the shear stress caused by twisting of the pipe due to thermal expansion, psi.
- t = the nominal thickness of the pipe wall, in.
- t' = the minimum thickness of the pipe wall, in.
- W = the weight of bare empty steel pipe, lb per ft.
- W' = the wind loading on the pipe, lb per ft.
- W'' = the total weight of the piping as installed including contents and covering, lb per ft. $W'' = W + Wc + Wi$.
- Wc = the weight of the fluid in the pipe, lb per ft.
- Wi = the weight of the pipe covering on the pipe, lb per ft.
- X = the distance of any point on the pipe from the origin, ft.

strong in support of the maximum shear theory.

For a further discussion of this theory, the reader is referred again to Part II, Strength of Materials, by Timoshenko, 2nd edition, page 480. According to this theory, the equivalent stress *Se* is defined as the tension stress in a tensile specimen which will produce in the specimen the same shear stress that is calculated to exist in the piping. Fortunately, the equivalent stress *Se* is not difficult to calculate.

In Fig. 10, a section is taken through a pipe at the point of greatest bending moment. For a fixed span, this will be directly over a support; whereas for a free span, it will be midway between the supports. Two points, *A* and *B*, are indicated in this section at which the stress will be at a maximum. At point *A*, the bending stress is placing the fibers in compression and *Sb* is considered negative. At point *B*, the bending stress is placing the fibers in tension, and *Sb* is taken as positive.

It can be shown that the equivalent stress, *Se*, is equal to the diameter of the largest Mohr circle of stress that can be drawn for point *A* or point *B*. In Fig. 11, the Mohr circles of stress are drawn for point *A*; and in Fig. 12, the circles of stress are drawn for point *B*.

From the geometry of Fig. 12, the following equations may be written to give the equivalent stress at point *B*.

$$Se = \pm \sqrt{(Sa+Sb-Sp)^2+4T^2} \quad \text{.....[72]}$$

$$Se' = (2Sr+Sa+Sb+Se+Sp)/2 \quad \text{.....[73]}$$

The above two equations will give the diameters of each of the three circles in Fig. 12. This follows because the value of *Se* as determined from equation 72 represents the diameter of one of the circles, and it has two values plus and minus when substituted into equation 73. In other words, one answer is obtained from equation 72 and two answers are obtained from equation 73. The above answers will show the magnitude of stress for point *B* in Fig. 10. The largest value so obtained is the one to be used in the design.

The same formulas will apply also for point *A* in Fig. 10 except that the bending stress *Sp* is in compression and will carry a negative sign. From this it is seen that two equations will yield six answers, three for point *A* and three for point *B*. Whichever of the answers is the largest, positive or negative, is the one that must be used in the design.

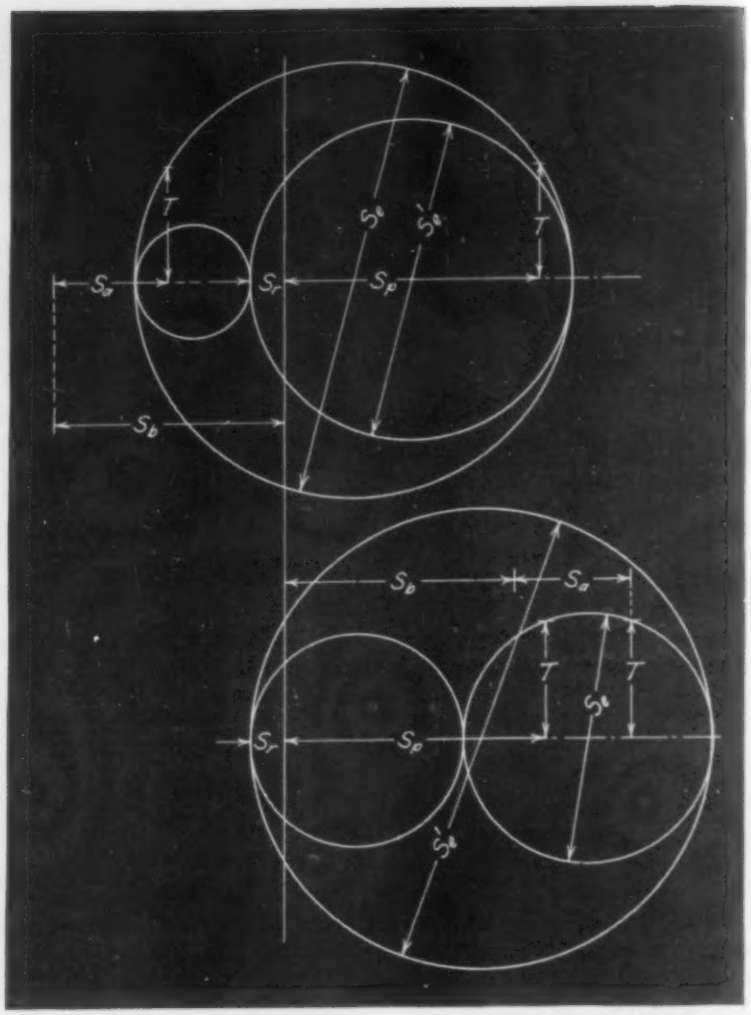


Fig. 11 *(top)*—Mohr circle of stress for point *A* in Fig. 10. *Se* and *Se'* are combined equivalent stresses based on the maximum shear theory. They are equal to the tension stress that would have to be generated in a tensile specimen to produce, in the specimen, the same shear stress that is calculated to exist in the piping. Fig. 12 *(bottom)*—The same Mohr circle diagram for point *B* in Fig. 10 as is shown in Fig. 11 for point *A*

It may occasionally be necessary to calculate several answers to be certain that the largest one has been determined. Each answer obtained above represents the maximum equivalent stress for each of three planes of stress at point *A* and also three planes for point *B*. Only the largest need be considered in the design.

In many cases, where the expansion bends are in one plane with the piping, the twisting stress *T* will be negligible and equations 72 and 73 above may be simplified as follows:

$$Se = Sa - Sb - Sp \quad \text{.....[74]}$$

$$Se' = Sr + Sa + Sb \quad \text{.....[75]}$$

$$S'' = Sr + Sp \quad \text{.....[76]}$$

Equations 74, 75 and 76 will each give different values for the equivalent stress *Se*, *Se'* and *Se"*, respectively. Only the largest answer so obtained need be used in the design.

[This is the third of a series of articles by Mr. Bridge on how to space pipe supports, the first two of which appeared in the October and November issues. A future article will show sample problems to clarify the procedure to be followed in solving actual problems.]

HEATING WITH THE HEAT PUMP

Analysis of Heat Losses and Operation

G. D. WETHERBEE, refrigerating engineer, has obtained considerable operating and performance data on an actual installation of a 5 hp heat pump job, the basic design of which was conceived and calculated by him. As a result, he feels certain that this method of heating will become accepted for regions with a normal heating season of around 6300 degree days. He presents an analysis of heat loss calculations, heat gains, and heat pump performance

A HEAT PUMP installation is never going to be competitive with fuel burning heating systems from the standpoint of initial investment but we *do* want to keep the investment as low as possible. To accomplish this, there will have to be a much smaller margin of safety in design calculations than is currently practiced by the heating industry. This in turn will require a better knowledge of heat losses and heat gains. Because of this, we have attempted to balance theory and practice based on actual results observed last winter on one installation.

A plan of the building, which is heated by a 5 hp compressing unit, a conventional duct system for air distribution, and a combination of earth-buried and atmospheric coils as a heat source, is shown herewith. The elevation section shows the details of the insulation.

Areas of heat loss surfaces of the building, which is located near Chicago, are listed in an accompanying table. Inasmuch as there are so many definitions for "volume," four are listed.

Reduction of Heat Losses

There is nothing special or different about the construction, with three possible exceptions. In all other respects, it is a standard brick veneer structure. The exceptions are:

1) Two thicknesses of 3 in. glass wool bats in the ceiling instead of one.

2) Top of concrete foundation does not extend much above earth level. Hence, the top 16 in. of the basement wall beneath the joists is fully insulated.

3) The large glass areas are set permanently in position. Double hung windows constitute a minor portion of the glass exposure.

The building is protected a little on the north and east by trees. The heated building is partly protected by the garage on the west. There is no protection whatever on the south but by the same token, it has the advantage of the full effect of the sun.

Heat Leakage Factors

The coefficients of transmission used in our calculations are taken from or based upon Chapt. 6 of the 1948 edition of the ASHVE Heating, Ventilating, Air Conditioning Guide.

A *U* factor of 0.070 is used for the *walls;* Table 5 in the Guide, Wall No. 28-D combined with Table 6, No. 42-C.

The *ceiling* will eventually be insulated with two 3 in. layers of bat type glass wool. At the time of writing, the first layer was complete but only half of the second layer had been installed. For the 3 in. portion, a *U* factor of 0.091 is used; Table 11 in the Guide, No. 5-K. For the 6 in. portion, a *U* factor of 0.060 is estimated.

For the *roof*, a *U* factor of 0.52 is used; Guide Table 16, No. 1-E.

Combining the *ceiling and roof* factors in Equation 5, p. 136, of the Guide, a ceiling and roof *U* factor of 0.066 is obtained for the partially insulated ceiling. By the same formula, a *ceiling and roof U* factor of 0.055 will exist after the ceiling insulation is complete.

Double windows had not been procured at the time of writing. Thus, the operation has been with *single glass windows* throughout. For *heat balance purposes*, a *U* factor of 0.94 has been used; the mean between the accepted coefficient of 1.13 from Table 18 of the Guide and 0.75 for still air. This privilege is taken on the assumption that the wind blows on only one-half of the glass. The actual average wind velocity was about 11 mph instead of 15 mph. It should be understood that this reasoning is not a criticism of 1.13 as a design factor *but the building was heated*, which it could not have been if 1.13 were the true average figure.

Areas and volumes of building

Plan area (outside of walls), sq ft	1433
Upstairs wall area (gross), 8 ft height, sq ft	1350
Upstairs window area, sq ft	335
Upstairs door area, sq ft	49
Upstairs wall area (net), sq ft	966
Basement wall area (gross), sq ft	1323
Basement wall area (insulated), sq ft	280
Basement window area, sq ft	13
Basement wall area (concrete), sq ft.	1030
Volume (over ceiling joists to under floor joists), cu ft	14,000
Volume (over ceiling joists to basement floor), cu ft	24,000
Volume (upstairs inside of walls), cu ft	10,300
Volume (upstairs and basement inside of walls), cu ft	19,300

Calculated heat losses for the building for 70 F indoor temperature

	Present construction			Ultimate construction
	65 deg-days per day	35 deg-days per day	15 deg-days per day	65 deg-days per day
Ceiling and roof	6600	3800	1900	5500
Upstairs:				
Walls	4700	2700	1350	4700
Windows	22100	12600	6250	11700
Doors	1700	1000	500	1700
Basement:				
Insulated walls	1100	500	150	1300
Concrete walls	2300	2300	2300	4500
Floor	1400	1400	1400	2900
Windows	700	300	100	800
Air change	8200	4700	2300	10000
Total Btu per hr	48,800	29,300	16,250	43,100
Btu per hr per degree-day	750	835	1090	663

For *double glass windows*, a *U* factor of 0.50 is arbitrarily assumed based upon a reduction from a design factor of 0.55 for the reasons given above. The 0.55 may be low on the basis of some recent research.

A *U* factor of 0.50 is used for the *single doors*.

For the *basement floor*, a *U* factor of 0.10 is used. Inasmuch as the basement was poorly heated, an actual temperature of 50 to 55 F existed near the floor. An earth temperature of 42 F is assumed. Hence, a temperature difference of 10 F is used.

For the concrete basement walls, the same *U* factor of 0.10 is used. A temperature difference of 20 F is indicated by the tests quoted on p. 137 of the Guide but this has been increased to 22½ F to compensate for the higher actual temperatures of 55 F to 60 F near the ceiling.

Air Change Equal to One-Third Volume

An *air change* equal to one-third of the inside volume per hour is used. This has been selected because the larger glass areas are permanently set, and the building is exceptionally tight.

The number is increased to four-tenths when a heated basement is assumed.

However, the author has serious doubts as to the accuracy of these figures. Are they not too low? If so, some other factor is too high.

The building was unoccupied during the day for five days a week. On Saturdays and Sundays, there was door opening and activity beyond average occupancy. Yet when the week-end days are grouped and analyzed, and the mid-week days are similarly studied, the heating plant operation per degree-day is found to be almost the same for each. This indicates that door opening was not an important heat load consideration.

Heat Load Calculations

The heat load of the building according to one simplified method used in this territory is as follows:

Glass area 335 sq ft, *90* if single glass	30,150
Wall area 966 sq ft, *10* if fully insulated	9,660
Ceiling area 1433 sq ft, *10* if fully insulated	14,300
Volume 10,300 cu ft upstairs, *1.5* if storm sash or weatherstrip	15,400
Total	69,510

The heat load of the building according to another method would be:

Glass area, 335 sq ft × 1.13 × 75	28,400
Wall area to earth, 1320 × 0.07 × 75	6,900
Ceiling area, 1433 sq ft × 0.066 × 75	7,100
Air changes, 1 per hr, 10,300 cu ft upstairs	14,200
	56,600

Basements do not seem to be considered in most rough heat loss calculations.

These figures are rather far apart. Neither method appears to take all losses into consideration and makes other losses too great. Therefore, it is attempted in an accompanying table to compute the heat losses for the building as it exists and to make the figures balance with the heat gains based upon actual experience and records and shown in the heat balance tabulation. In Nature, things *do* balance. If our figures do not check with actual observations, then there is something wrong with our figures. However, the only deviations from accepted design factors comprise:

1) *U* factor for single glass
2) Air changes.
3) Credit for sun effect.

The heat losses in the first part of the table are for the building as it was last winter. Calculations were made for days with mean outdoor temperatures of 0 F, 30 F, 50 F. The second part of the table represents an attempt to predict the load when the ceiling insulation is complete, the windows double glazed, and the basement heated.

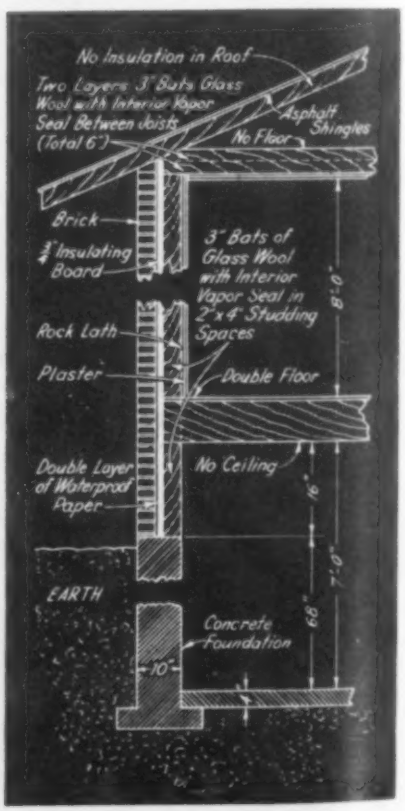
Effect of Sun Analyzed

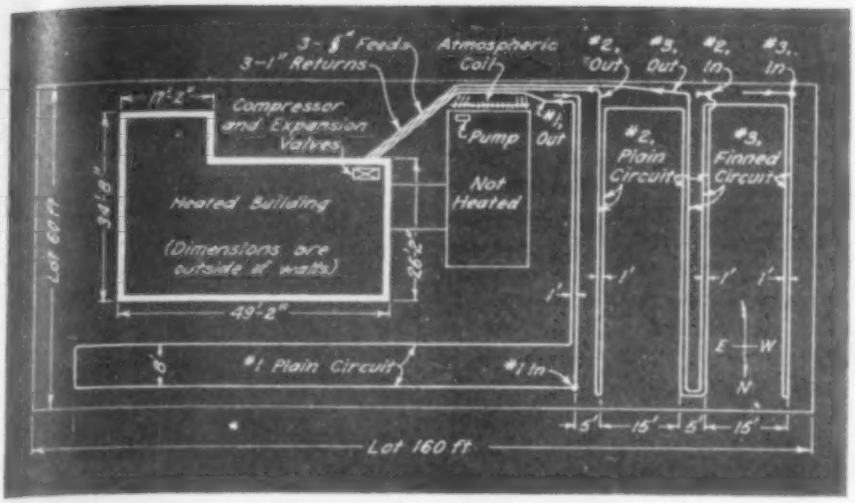
From Weather Bureau records, two sets of days in January and February were selected. One set included 15 days with nearly 100 percent of possible sunshine and the other set included 20 days with almost no sun. The data follow:

	Sunny	Sunless
Number of days	15	20
Hours of operation	170.92	218.25
Degree-days	650	682
Average degree-days	43.3	34.1
Hours of operation per degree-day	0.263	0.320
Hours of sunshine	137	0

The decreased operation of the heat pump on the sunny days as compared to the sunless days was 0.320 less 0.263 = 0.057 hours per degree-day. On the sunny days,

Section showing building construction and insulation





Plan of the building showing also the coils. The ⅝ in. tubing feeds from the expansion valves to points marked (•) and "in"

less heat was required to the extent of 0.057 × 650 degree days × 56,500 Btu per hr (heat pump capacity) = 2,100,000 Btu. If this decrease is a result of sunshine, it amounts to 2,100,000 Btu/137 hr = 15,400 Btu per hr. The south exposure of the building in elevation is about 800 sq ft. Thus the sun effect is a little less than 20 Btu per hr per sq ft, which seems to be within the realm of reason.

Heat balance for building (heat loss vs. heat gain) based on performance January 8 through January 30, 1949

Basic Facts	Elapsed time = 22 days = 528 hr	
	Electric service meter 3443 — 1997 = 1446 kwhr (used for compressor motor, blower, and all domestic services)	
	Compressor motor operated 254½ hr	
	Degree-days = 846	
	Average day = 38½ degree-days	
	Sunshine = 66 hr	
Heat Loss	Heat loss in Btu per hr per degree day based upon calculated heat loss for 38½ degree-day level = approx. 825 from heat loss table	
	Total heat loss for 22 day period is 825 × 24 hr × 846 degree-days = 16,700,000 Btu	
Heat of Refrigeration	Rated refrigerating capacity at 163 psi and 21 psi = 34,300 Btu per hr	
	Corrected for actual operating conditions	
	57/48.5 (see p. 89, September HPAC) = 40,400 Btu per hr	
Heat Gain	Heat gains = refrigeration + electricity + occupancy + sun	
	254½ hr × 40,400 Btu per hr	= 10,300,000 Btu
	1446 kwhr × 3413 Btu per hr	= 4,900,000
	1½ people × 450 Btu per hr × 528 hr	= 400,000
	Sunshine, 66 hr × 15,400 Btu per hr	= 1,000,000
	Unaccounted for	100,000
	Total heat gain	16,700,000 Btu
Distribution of Heat Gains	Heat from refrigeration	61.6 percent
	Total electrical heat	29.3
	Heat from occupancy	2.5
	Heat from sun	6.0
	Unaccounted for	0.6
		100.0 percent

Comparison of mild and cold days (actual January operation)

Outdoor temp. in deg-days	No. of days	Unit operation, hr	Deg-days	Unit operation, hr per deg-day
19-29	7	63.25	167	0.379
30-39	14	151.56	482	0.317
40-49	8	102.08	363	0.283
50-63	2	33.50	122	0.275
	31	350.39	1134	0.309

However, the sunny days were also colder than the sunless days and the heat loss calculation shows that the equipment should operate less per degree-day on cold days than on warm days. There is thus reason to question whether or not the decreased operation is entirely due to the sun.

It became even more of a question when, during a 10 day period in May when the building was not occupied, the indoor temperature at the end of the period was almost exactly the same as the average outdoor temperature of the preceding days which were quite sunny. It may be that the cooling effect of the cold basement offset the heating effect of the sun.

Cross Check Verifies Analysis

The "sliding scale" results at the bottom of the accompanying heat loss table seem to be verified within reasonable limits by the actual operation during January.

A comparison of operation on mild and cold days in January is given in another table. The days are placed in four groups and the hours of operation of the compressor per degree-day are calculated.

The heat loss table shows that the heat loss is only 69 percent as much per degree-day in the coldest column (65 degree-days) as in the warmest column (15 degree-days).

The comparison table shows the compressor operates only 72 percent as much per degree-day in the coldest group (average 61 degree-days) as in the warmest group (average 24 degree-days).

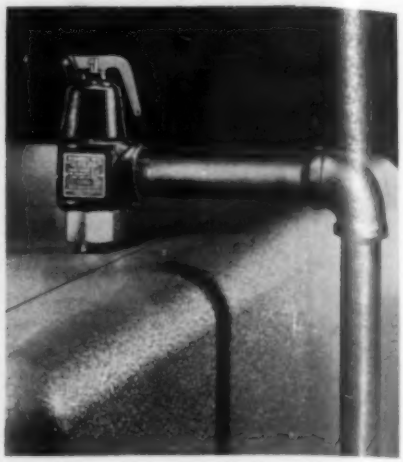
[This is the third article by Mr. Wetherbee on this heat pump installation. The others were published in the July and September issues.]

HOW IT STARTED

STATIC ELECTRICITY from a man's body was blamed for a recent fire in a paint factory, says the National Board of Fire Underwriters. When he opened a lacquer thinner valve, flames shot out into the room.

In another city, $60,000 damage was caused when an engineer went into the basement of a building to investigate a gas odor. He turned on a light, and a spark from the switch set off an explosion.

Why Rated Hot Water RELIEF VALVES?



A safety relief valve for hot water heating boilers

JOHN JAMES, chief research engineer, McDonnell & Miller, Inc., discusses here various provisions of the ASME boiler construction code pertaining to adequate relief valve protection for hot water heating boilers. The need for such protection on hot water boilers is well reflected in several published research reports

IT HAS BEEN commonplace for many years for steam boilers to be provided with ASME rated and certified steam safety valves having adequate capacity to relieve all of the boiler load if the need arose.

However—despite the tremendous strides in recent years toward the development of equipment for hot water heating systems—it is questionable whether many engineers realize that the American Society of Mechanical Engineers' code* is equally specific about adequate protection for hot water boilers.

The need for adequate relief valve protection on hot water boilers is well reflected in the published research reports of several testing agencies† that have investigated the subject thoroughly. Based on the findings of these groups and other authorities, the ASME code outlines five basic provisions for the selection of relief valves, which will be discussed here.

1) **"Each hot water heating . . . . . boiler shall have one or more relief valves . . . . . set to relieve at a pressure at or below the maximum allowable working pressure of the boiler . . . . . ."**

Whether a boiler is of residential size or suitable for a large commercial installation, it will be observed that the code is specific regarding the fact that *each* boiler shall be provided with a relief valve. Despite the fact that this particular section of the code does not mention an *ASME rated* valve, it is certain that this is intended, for as later developed in subsequent code provisions, detailed procedures are outlined for testing, rating and certifying the capacity of each valve.

To comply fully with this provision, it readily becomes apparent that it may be necessary to provide for a multiple valve installation in order satisfactorily to match the gross boiler output.

Even though the code stipulates that all low pressure heating boilers shall be constructed to withstand at least hydrostatic tests from 1.33 to 2.5 times the maximum allowable working pressure, sound engineering principles dictate that the relief valve be set to open within close limits of the allowable working pressure stamped on the boiler.

When the static head and operating pressure requirements on multiple floor installations approach or exceed the 30 lb allowable working pressure, it is advisable to select a boiler with high enough working pressure to withstand all of the imposed pressure limitations. Along with the selection of a high pressure boiler, it should also be kept in mind that all radiation, convectors, coils, piping and other auxiliaries must be capable of standing the additional pressure.

Frequently, on a multiple story installation, it is common practice to use a conventional low pressure steam boiler with converters located at various floor levels which heat the water for circulation to limited sections of the building. In such a system it is equally important to provide a relief valve set to open at a pressure to match the equipment on the system having the lowest allowable working pressure.

2) **". . . . . all be tested for capacity at 10 percent over the 30 psi required set pressure. . . . . at a place . . . . . approved by the boiler code committee. . . . . in the presence of, and certified by, an authorized observer."**

*Rules for Construction of Low Pressure Heating Boilers, Section IV, ASME Boiler Construction Code, 1946 Edition.

†Tests of Hot Water Pressure Relief Devices, by Paul Bucher (Proceedings, 18th General Meeting, National Board of Boiler and Pressure Vessel Inspectors, May 1948).

A Research on Water Relief Devices—Some Interesting Tests on Their Characteristics and Specifications (Engineers' Conference Committee, National Bureau of Casualty & Surety Underwriters, 1940).

Due to the fact that the critical operating condition for a hot water relief valve occurs when the valve opens at 30 lb, it follows that the accumulated energy in the high temperature water will cause the water to flash into steam as it is subjected to atmospheric pressure in passing through the valve orifice. This explanation justifies the reason for testing relief valves under steam conditions with the rating either expressed in terms of lb per hr of steam, or Btu per hr.

The laboratory of the National Board of Boiler and Pressure Vessel Inspectors at Columbus, Ohio, is currently approved for conducting safety and relief valve rating tests. Under present arrangements, a valve manufacturer submits three valves of each size and design from which a determination of average steam capacity is established.

3) ". . . . . relieving capacity that may be stamped on the valves shall not exceed 90 percent of the value determined by the witnessed tests."

The capacity test in the previous provision stipulated that the valve should be tested at 10 percent over the 30 psi set pressure, which would seem to imply that the valve is being given the benefit of a greater relieving capacity than justified. However, in this provision a balancing factor of 90 percent is applied to the actual test result, which establishes the net relieving capacity in lb per hr of steam.

Detailed provisions in another section of the code specify that if it is desired to express the capacity in terms of Btu per hr, it is permissible to multiply the steam capacity in lb per hr of steam by the round number 1000 in order to establish the rating in Btu per hr.

It should be kept in mind that all of these ratings refer to a capacity which is intended to match the *gross* output of the boiler. Many times manufacturers, in listing the load capacities of a boiler, show a catalog *rating* or *net rating* to which a suitable piping and pick-up factor must be applied to obtain the *gross* output.

After the above certified test has been obtained, a manufacturer is then privileged to make application to the American Society of Mechanical Engineers for permission to use the official symbol of the society, letter *V* in a cloverleaf, on the valve nameplate. Frequently, the letters *NB* are added to indicate to all inspectors that the valve was tested and rated by the National Board of Boiler and Pressure Vessel Inspectors.

4) ". . . . . shall be connected to the top of boilers, with the spindle vertical, if possible . . . . . ."

This may be classed as an installation procedure, but it is exceedingly important as it has been proved through extensive tests that the relief valve should be located on the top of the boiler.

Important reasons for this are:—(1) The valve should be located at the hottest point where it will discharge the greatest number of Btu; and (2) when it is connected to the top of the boiler, the likelihood of a dangerously low water level quickly developing is minimized. If located on the return line or cold water supply the valve will discharge water at a faster rate due to the development of a steam space (in the top of the boiler) having a greater volume than its corresponding water volume.

5) "The discharge from . . . . . relief valves shall be so arranged that there will be no danger of scalding attendants."

The use of a top outlet discharge in the case of a steam safety valve is not seriously objectionable. However, in the case of a hot water relief valve, this is a very important consideration, because of the discharge of large quantities of high temperature scalding water. Hence, it is essential that precautions be taken to utilize a side outlet valve design with provisions for piping the discharge to a suitable drain.

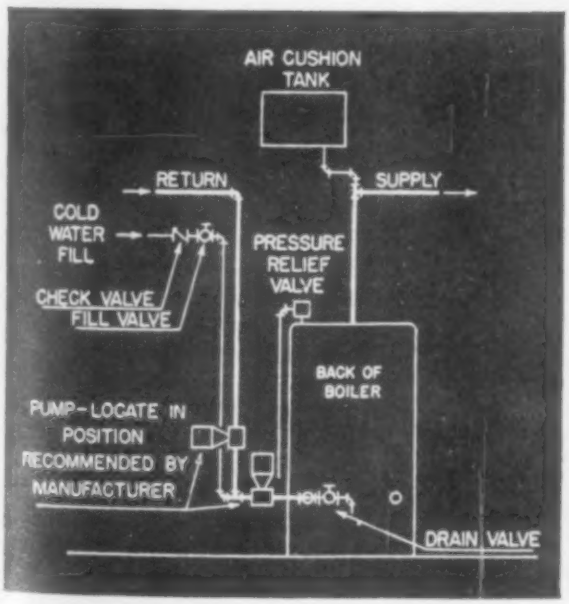
* * * * *

The answer to the question, Why rated hot water relief valves?, is found therefore in the recognition that the ASME boiler code committee has given to the need for equipping all hot water boilers with a properly designed relief valve.

Official symbol for stamp to denote the ASME standard

In brief, the ASME code requirements provide that this relief valve be tested, rated and certified with adequate capacity to dissipate the gross output of the boiler, and prevent the pressure from rising above the allowable working pressure of the boiler.

Relief valve shown connected to top of boiler with piped discharge (from Institute of Boiler and Radiator Manufacturers' installation guide No. 100)



URGES MORE TIME TO "PRACTICAL POLITICS"

ASSERTING THAT all the basic economic ingredients are present to start the country off on a new cycle of prosperity, Cloud Wampler, president of Carrier Corp., declared last month that this alone is insufficient since these factors "are unalterably mixed up with the political ingredients."

Addressing the annual conference of the Society for Advancement of Management, he urged businessmen to give more of their time to "practical politics"—selecting and electing good men to public office. He also called for more statesmanship on the part of businessmen in the matter of government economy, saying that too many were for economy for everybody else but complained when such a move hit their own community or their own company.

QUESTION OF THE MONTH

Practical Pointers on How To Ventilate Club Kitchen

VENTILATING a club kitchen was the "Question of the Month" several issues ago, and in analyzing the problem, it does not seem advisable to me to have outside air forced into this kitchen as was suggested at the time. If this were done, the kitchen would be under pressure which would be relieved through doors and windows. This would no doubt force kitchen odors through the passage and to the dining room. Sufficient air required to exhaust the heat from the ranges would therefore not be available.

It is suggested that a hood and filters, as shown in the accompanying sketch, should be provided over the four ranges with a minimum of 12 in. overhang. The existing exhaust duct from the original hood should be changed to meet code requirements. An exhaust fan should be provided at the top of this duct.

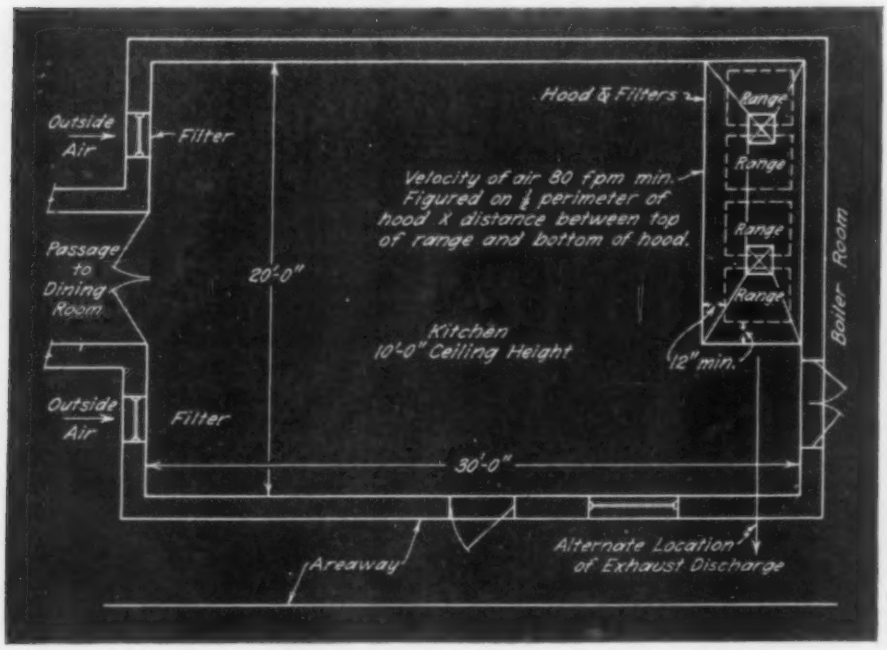
An alternate method of exhaust to the areaway is suggested (if this meets with the code requirements) as this scheme will be less expensive and will eliminate the fire hazard through the frame structure above.

As shown on the sketch two exhaust connections should be provided from the top of hood in order that fairly equal distribution will be obtained at the perimeter of hood. Outside air should be introduced at the two windows; this will assure a fairly even coverage of this air across the kitchen area. It is advisable to have filters on the outside air intakes. All other windows and doors should be kept closed, in order that short cycling of air from these locations may be eliminated.

The door to the boiler room should be well sealed in order to eliminate air being drawn through it. If outside air is required in winter through the two window openings, some form of heating this outside air will be required before delivering it to the kitchen area. With the information furnished, it seems that sufficient air will have to be supplied and exhausted to satisfy the required velocity at the hood in about one change per minute.

I hope that the above notes will be helpful. A complete survey of the job should of course be made before proceeding with the actual design.—A.B.

Suggestions from "A.B." for ventilating a club kitchen are sketched here



READER WANTS HELP ON SCHOOL BOILER JOB

YOU ARE INVITED *to answer the following question from a reader of HPAC. Suitable comment on the matter will be welcomed and—space permitting—will be published and paid for at regular rates. Sketches and photos are particularly desired. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

"We have a problem in a high school that we would like to know how to handle. There are two 13 section, 5200 sq ft radiation, boilers. It is desired to convert one of the boilers to automatic gas firing.

"Both boilers are connected to one breeching and one stack and there is not enough space in the boiler room to run a separate smoke pipe for the proposed gas fired boiler.

"Due to the odd setup, I am at a loss to know how to make this installation. Any suggestions would be appreciated."—A.H.

SHEET METAL APPRENTICES TO COMPETE

AN APPRENTICESHIP contest for first and second year apprentices has been announced by the National Sheet Metal Contractors Association and the Sheet Metal Workers' International Association, with winners from various localities competing for national awards.

All fittings are to be judged "by their neatness, accuracy and general workmanship."

Full information may be had from Joseph J. Kaberlein, 5911 N. Mobile Ave., Chicago 30, secretary of the National Joint Sheet Metal Workers' Apprenticeship Committee.

Heating, Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

Condensation on Prefabricated Walls

By E. R. Queer* and E. R. McLaughlin**, State College, Pa.

SUMMARY—The tests for condensation described in this paper apply to walls used in small tightly constructed dwellings. Forty-four samples of prefabricated walls were exposed to moderate and severe weather conditions. Exposure was from 14 to 29 days. The effect of paint and other coatings and the effect of different kinds of insulation were also studied. Among the conclusions offered are: a good vapor barrier on the warm side of the wall is desirable; the advantages of a metal exterior surface are frequently offset by condensation; organic materials are not desirable in the walls, because under certain conditions, mold and fungous growth develop in a short period of time.

THE WALLS of a dwelling are designed to be a barrier between the elements of the weather and the occupants. By trial and error and a little objective thinking satisfactory combinations of materials were discovered. Certain combinations were acceptable for many years until changes in living habits and economic values necessitated alterations in the wall structures. Out of consideration for comfort, the use of insulating material within the wall seemed desirable. The reduction in the cost of fuel for heating was a type of amortization for the cost of including the insulation. Comfort and fuel costs also required that the structure be as tight as possible to reduce infiltration losses and drafts. In many cases the obvious advantages of such procedures overshadowed the lurking danger of condensation.

Consequently, many structures were completed without any thought of providing adequate protection for the structure against the moisture released within the house. When the problem became severe enough to attract engineering attention, the cause was recognized and remedial measures were suggested. As new materials become available and as new uses for common materials are proposed, they must be examined for possible difficulty with condensation. Since corrective measures can be costly, every effort should be directed toward avoiding all objectionable condensation when utilizing new materials or new combinations of materials. It is mandatory, therefore, that the mechanism of water vapor transfer be recognized by those interested in any responsible phase of the building trade.

There are so many facets to the condensation problem that field observations are not sufficient in appraising the performance of a typical construction even though field performance is the ultimate criterion. Surveys of conditions imposed on house structures have been very helpful in formulating the conditions to be used in laboratory tests. Additional survey work may be necessary to correlate laboratory results with field results.

Laboratory tests were designed to reduce to a common denominator the conditions imposed upon the test walls. Insofar as possible, all walls of a series, approximately a dozen, were simultaneously subjected to test conditions of moderately severe magnitude. Time of exposure to prescribed conditions was deemed to be equal to or more severe than conditions likely to be encountered in service.

The Thermal Research Laboratory of the Engineering Experiment Station at The Pennsylvania State College has a Climatometer with facilities for subjecting a number of full size test panels to a range of temperatures and humidities.

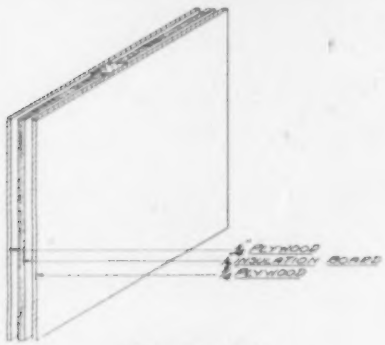
Test Apparatus

Panels were set around a platform, 14 × 17 ft, in an insulated test room 20 × 30 ft with a height of 17 ft. All panels were full sized samples supplied by the manufacturer. Temperature outside the test house and temperature and humidity inside the test house were under automatic control. Temperatures were measured at 12 locations on and within the wall. Permanently

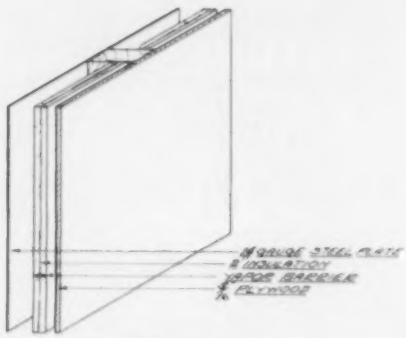
*Professor of Engineering Research, Engineering Experiment Station, The Pennsylvania State College. Member of ASHVE.

**Associate Professor of Engineering Research, Engineering Experiment Station, The Pennsylvania State College.

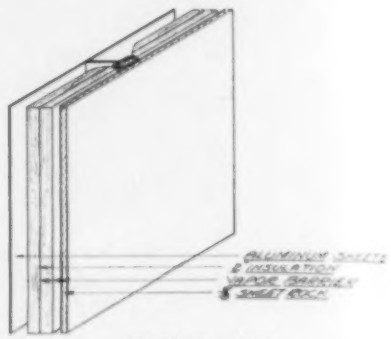
For presentation at the 56th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Dallas, Tex., January 1950.



Wall Panel 1



Wall Panel 2



Wall Panel 6

installed brass points were used for electrically determining the moisture content of sheathing and siding. Dew points of air mixtures were determined by dew-point cup.

Visual observations for condensation in the cavity were made through access doors in the exterior covering of the wall. Doors at top and bottom gave some hint as to where the condensation was forming, if any. In certain cases, alterations were made as deemed advisable after initial tests were complete. See Table 1 for a summary of test conditions.

Wall Panel 1 was constructed with ½ in. insulation board between two inch framing members. The interior and exterior finish was ¼ in. exterior grade fir plywood. The interior surface was painted one coat resin sealer and two coats inside white paint. The exterior was covered with two coats outside white paint. This wall showed no evidence of condensation under conditions A, B, C and D. This was attributed to the effective interior sealer and paint coat and also in a small measure to the ventilation of the cold air space to the weather through holes ¼ × 4/32 in. provided for the purpose. This is relatively little ventilation, averaging 1/50 sq in. per linear foot of wall.

Wall Panel 1a was a variation of Wall Panel 1 in that the interior finish was removed with paint remover. Condensation was not observed under conditions C and D.

Wall Panel 2 with a sheet steel exterior seemed to violate good engineering requirements. Insulation was a nominal 2 in. Balsam wool with vapor barrier. Interior finish was 5/16 in. rough Douglas fir plywood with two coats of lead and oil paint. The sheet steel exterior was an excellent barrier which showed evidence of condensation under condition A and considerably more condensation under condition B.

It was believed that ventilating the cold space where condensation was found would permit what vapor was passing through the paint, plywood, and barrier on the balsam wool to pass on through to the weather. Accordingly, 1-⅛ in. diameter holes, 1 sq in. each, were cut in the steel exterior at the top and bottom to provide 1 sq in. per linear foot of wall, top and bottom. No evidence of condensation was found in the cavity of this wall after exposure to conditions C and D.

At the sill the metal exterior turned in to meet the interior plywood finish. Condensation was noted on the room side of the plywood under all conditions A, B, C and D.

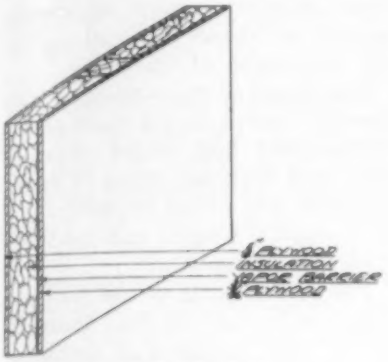
Wall Panel 6 was constructed in such a way that the returned edges of the exterior metal siding served as a stud to hold a wood nailing strip that supported two inches of insulation and ⅜ in. gypsum board. One layer of insulation extended down over the inside surface of the metal sill channel to insulate what would otherwise be a cold surface behind the base board. The gypsum board was foil backed to provide an excellent vapor barrier. There was a vapor barrier on each 1 in. layer of insulation. The cold cavity was vented through slots ¼ in. wide and 2 in. long and spaced to provide 1 sq in. of opening per linear foot of wall top and bottom.

It is to be noted that this wall was well provided with vapor barriers well applied and ample ventilation to the cold cavity. All edges of the insulation were secured, vertical edges were tacked to the wood strips in the metal studs, and horizontal edges top and bottom were cemented to the metal framing channels.

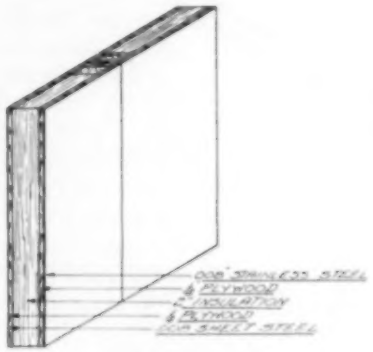
No evidence of condensation was observed under conditions A and B. The ventilation slots in the exterior metal sheet were sealed and the test was continued under conditions C and D. There was no evidence of condensation within the wall cavity. The metal return forming the stud provided a path of low resistance to heat flow and created

Table 1—Summary of Test Conditions

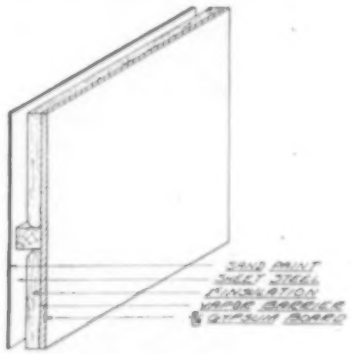
	Inside		Outside		Time days	Vapor Pressure Difference lb/sq in.
	Temperature F	RH %	Temperature F	RH %		
A	70	46	20	78	20	0.125
B	70	38	0	73	16	0.125
C	70	38	0	73	29	0.125
D	80	38	0	73	11	0.178
E	70	52	20	78	14	0.150
F	70	52	0	73	26	0.150
G	70	45	30	70	14	0.100
H	70	40	20	60	14	0.115
I	70	40	0	60	14	0.130



Wall Panel 7



Wall Panel 17



Wall Panel 20

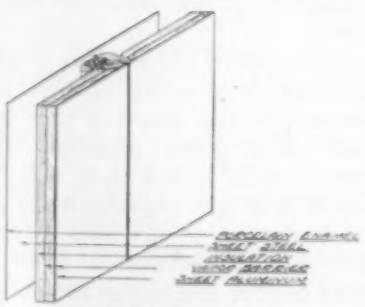
a relatively cold area on the interior surface directly over the nailing strips. The nails used in fastening the gypsum board to the wood strip were badly rusted.

Wall Panel 7 was of stressed plywood design, using ¼ in. plywood for the interior and exterior finish, with framing members 2-¾ in. thick. Framing members were horizontal on 16 in. centers. Panels were 40 in. wide. One coat of varnish sealer, one coat of undercoat, and two coats of oil paint provided the finish for the exterior and interior. This provided an excellent vapor barrier on both surfaces to supplement the barrier paper on the mineral wool. The insulation filled the 2-¾ in. space between plywood faces.

No evidence of condensation was observed at any point in this wall under conditions A, B, C and D.

The paint was removed from a section of the interior face of this panel to expose the ¼ in. plywood. No evidence of condensation was found in this section after exposure to conditions C and D.

Wall Panel 14 was a metal wall in which the aluminum panels forming the interior surface had four inch flanges which clipped together to form the studs. Two inches of insulation were cemented to the cavity side of the interior panels. Porcelain enameled sheets 2 × 4 ft were applied horizontally with all joints sealed with caulking compound. Ventilation to the 3 in. cold cavity was about ½ sq in. per linear foot of wall both top and bottom.



Wall Panel 14

No evidence of condensation was observed in this wall under conditions E and F except as follows. After 25 days were completed under condition F, the outside temperature dropped to —10 F and a light layer of frost was observed on the interior surface of the porcelain enameled sheets. It is quite possible that this moisture was released by the hygroscopic insulating material faster than the ventilation could carry it away. The exterior sheets were only 4 deg above the ambient air temperature and did not provide much margin for rapid changes in ambient temperature.

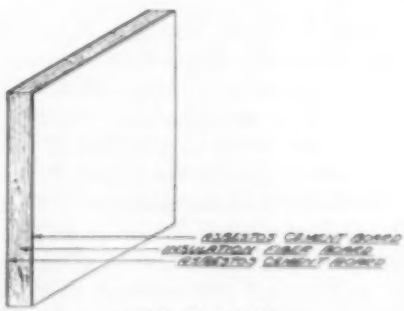
Wall Panel 17 had thin sheet steel bonded to ¼ in. plywood with thermosetting adhesive. The two inch space between plywood faces was filled with cotton insulation. This formed a wall with an excellent vapor barrier on each surface and hygroscopic material between.

No evidence of condensation was observed under condition E. After exposure to condition F, frost was observed on all access doors. Slight condensation was also observed at the top and bottom of the joint in the interior finish. The thin sheet steel was turned outward at this point to cover the framing member, thereby producing a path of low resistance to heat flow.

Wall Panel 20 had an exterior surface of galvanized sheet steel in tension, primed, covered with exploded slag, and painted. Studs were metal, 39 in. on centers. Horizontal wood furring strips held the 1 in. blanket insulation with a vapor barrier on each face. Interior finish was ⅜ in. plain gypsum board. The cold cavity was ventilated by openings of 2-¼ sq in. per linear foot of wall.

No evidence of condensation was observed in the cavity of this wall under conditions E and F. Under both conditions, however, condensation was observed on the heads of the nails holding the ⅜ in. gypsum board. Condensation was also observed at the four corners of the panel where a heavy flange on the framing member turned in to approach the gypsum board and cause a cold spot at each corner.

Wall Panel 21 was a sandwich wall and had no cavity. Two sheets of ⅛ in. asbestos cement board were applied with bituminous adhesive to opposite surfaces of 1-5/16 in. insulating board core. All edges



Wall Panel 21

were sealed with a coat of special paraffin. No paint was applied to either inside or outside surfaces.

This wall showed no evidence of condensation under conditions E and F until the ambient temperature dropped to —10 F on the 26th day of condition F. At —10 F there was a 1 in. wide band of condensation along the lower edge of the panel. Following tests at conditions E and F the average moisture content of the wall was 12.2 percent. Visual inspection indicated that moisture accumulation was heaviest in the outer ¼ in. of the fiber board core.

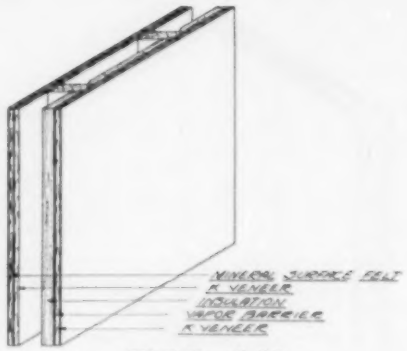
Wall Panel 22 was a sandwich wall similar to Wall Panel 21 except that the outside surface was painted with one coat of cement water paint and the inside was painted with one coat of Vinyl type primer and two coats of alkali resisting semigloss paint. No condensation was observed under condition E. When the temperature dropped to —10 F on the 26th day of condition F, beads of condensation were evident 6 in. from the floor at the center of the panel and up 4 ft at the edges of the panel. Average moisture content was 5.8 percent at end of test.

Wall Panel 23 was similar to Wall Panel 21 except that the outside was covered with one coat of cement water paint and the inside was painted with one coat of base coat oil paint and two coats of semigloss paint.

No condensation was observed in this panel under conditions E and F until the temperature dropped to —10 F on the 26th day of condition F. At that time condensation appeared on the bottom 6 in. of the panel and up 2 ft at the joint. Average moisture content was 3.5 percent.

Wall Panel 24 was the same as Wall Panel 22 except that the sample contained a "T" type wood stud joint with a wood batten. Condensation was noted at the foot of the joint under conditions E and F.

Wall Panel 25 was similar to Wall Panel 22 except that the joint was an assembly of two pieces of ¼ in. × 4 in. × 8 ft asbestos cement board acting as battens and attached by ¼ in. bolts through the wall sample on 12 in. centers.



Wall Panel 26

Heavy condensation was observed on the nuts and bolts at the joint under conditions E and F.

Wall Panel 26 was fabricated with 1 × 3 in. studs on 8-½ in. centers covered with 3/16 in. Douglas fir veneer. The interior veneer was treated on the cavity side with a trowel coat of high melting point asphalt, including one inch return on the face of the studs. One inch of insulation was stretched from top to bottom and held in place by cleats and the asphalt. This provided a 1-¼ in. cavity on the cold side of the insulation. The veneer surfaces of the panel were covered with a bonding coat of urea adhesive and 30 lb kraft paper. The exterior surface was protected by a bonding coat of casein glue and 90 lb (per 100 sq ft) mineral surfaces roofing. No paint or wall paper was applied over the interior veneer and kraft paper.

No evidence of condensation was observed in this panel under conditions E and F.

Wall Panel 27 was similar to Wall Panel 26 except that a sheet of felt weighing 15 lb per 100 sq ft and highly saturated with asphalt was added between the 1 in. insulation blanket and the trowelled coat of high melting point asphalt.

No evidence of condensation was observed in the cavity of this wall after exposure to conditions E and F. After 19 days exposure to condition F, the kraft paper on the interior surface showed damp spots just above the floorline. After 26 days exposure to condition F, the same area was damp and spotted with a blue green mold, apparently feeding on organic material used in the fabrication of this wall.

Wall Panel 28 was similar to Wall Panel 26 except that a sheet of felt impregnated and coated with asphalt and weighing about 17 lb per 100 sq ft was added between the 1 in. insulation blanket and the trowelled coat of asphalt.

The performance of this wall was identical to that of Wall Panel 27 except that the area of dampness was greater (up to 5 in. above the floor) and the amount of mold was greater.

Wall Panel 29 was similar to Wall Panel 26 except that, in lieu of the trowelled-on coat of high melting point asphalt, the vapor barrier was a sheet of paper impregnated and coated with asphalt and weighing 11 lb per 100 sq ft with edges glued and tacked to studs.

This wall performed in much the same way as Wall Panel 27. The interior surface of the kraft paper was damp 3 in. above the floor although the mold was not as severe as it was on Wall Panels 27 and 28.

Wall Panel 30 was similar to Wall Panel 26 except that, in lieu of the trowelled-on coat of high melting point asphalt, the vapor barrier was a sheet of asphalt saturated felt weighing 15 lb per 100 sq ft, with edges glued and tacked to studs.

Observations on this wall were similar to those made on Wall Panel 26. The interior surface was wet 3 in. above the floor line with a few spots of mold on the damp area.

Wall Panel 41 was constructed of metal frame with 1 in. glass fiberboard insulation between studs. The exterior finish was slater's felt and painted aluminum clapboards. The interior finish was metal lath and plaster with two coats of water paint.

Condensation formed very quickly on the metal siding under condition G. It was observed that the panel had been plastered five months prior to the tests, but the plaster was not considered dry at the beginning of the tests. Water paint is not considered to be a vapor barrier and in the absence of any other barrier considerable

moisture might flow through the plaster and insulation to the cold siding. It is believed that moisture was removed from the plaster too.

After this wall was exposed for one week to condition H, heavy frost was observed on the inner surface of the lower siding. At that time vent holes were drilled through the siding and the sheathing paper. Six 9/16 in. diameter holes were drilled 6 in. on centers to provide ½ sq in. vent area per linear foot of wall. An additional week's exposure to condition H produced no net change in the quantity of condensation.

After this wall was exposed two weeks to condition I, the quantity of condensation on the siding was reduced so that frost covered 50 percent of the area of the observation ports.

Condensation appeared on the warm surface of this wall up to 15 in. above the floor level. It was observed that there were considerable plaster droppings at the foot of this wall.

Wall Panel 42 was similar to Wall Panel 41 with the substitution of two coats of aluminum paint for the two coats of water paint on the interior surface. This wall was plastered five months prior to the beginning of tests. This panel showed very little condensation under conditions G and H, and no vent holes were drilled in the siding. After this wall was exposed to condition I, frost covered 50% of the area of the observation doors. Condensation occurred on the room surface up to 18 in. above the floor level.

Wall Panel 43 was similar to Wall Panel 41 with the exception that the 1 in. insulation had been omitted. The performance of this wall was similar to that of Wall Panel 41 with the exception that condensation was more marked on the lower part of the sheathing and the lower part of the interior finish. Condensation extended upward 20 in. on the room surface. Ice was evident opposite one stud and the bottom channel.

Wall Panel 44 was similar to Wall Panel 41 except that an aluminum foil covered kraft paper was installed between the insulation and the plaster base. This barrier was not fastened at its edges. Plastering was completed only 10 days prior to the beginning of the tests.

Condensation formed very quickly on the metal siding under condition G. After this wall was exposed for one week to condition H, heavy frost was observed on the lower access door. Vent holes were drilled through the siding to provide ½ sq in. of vent area per linear foot of wall. After the wall was exposed for an additional week to condition H, it was evident that the frost was evaporating. Heavy frost accumulated on the upper access door during two weeks exposure at condition I.

Discussion of Results

The results of laboratory tests are enhanced when they can be interpreted for practical use. The tests reported herein were intended to determine the performance of a construction when subjected to moderately severe conditions. Time was a factor and a reasonable acceleration was desired. Acceleration could not be carried too far, however, so that a 14-day test period seemed to be the minimum time of test. The sequence of exposure for any test panel was from moderate to severe so that the performance under moderate conditions could be observed first. In this way, a panel which failed under moderate conditions could be rejected or revised for tests under more severe conditions. On the other hand, those panels which withstood testing under moderate conditions were seasoned to a certain extent before beginning the more severe tests.

The purpose of the testing program was more than a comparison of a number of constructions. The purpose was to show a measure of performance for each panel under service conditions. To help evaluate the results of the test series, a number of criteria were suggested and developed during the test program. It was deemed necessary to keep the criteria applicable to wall constructions which might be used in small tightly constructed dwellings. For this reason, the failure of a type of construction to meet any one criterion does not eliminate the construction from consideration for larger buildings with warm floors and relative humidities lower than the humidities used in the tests. Likewise, a summarized statement of the performance of a wall cannot include a qualified statement of the degree of divergence from an arbitrary criterion. For this reason, slight traces of condensation that were judged to be unimportant were ignored and the summary indicates that there was no condensation. The term condensation cannot indicate the degree of accumulation of frost or water and was therefore used for all cases where the quantity of condensation was judged to be significant to the performance of the construction. Fortunately, there were not many borderline cases where the degree of condensation was such that a positive rating was in doubt.

Judging Wall Performance

The performances of some of the walls tested are summarized in Table 2. The following criteria were used in judging the performance of the walls under the conditions of the tests.

Criterion 1. There shall be no evidence of condensation within the cavity of the wall, or between any of the various layers of materials making up the sample after 14 days' test.

Criterion 2. There shall be no evidence of condensation on the room surface of the wall after 14 days' test.

Criterion 3. A study of reliable psychrometric data shall indicate that the dew point of the air in the cavity shall always be lower than the coldest surface temperature in contact with it.

Criterion 4. A study of reliable psychrometric data shall indicate that the dew point of the air in the cavity shall average at least 5 deg below the coldest surface with which it comes in contact during the 14-day test period.

Conclusions

This series of tests indicates that several conditions should be avoided in prefabricated construction, particularly in construction using materials having low resistance to heat transfer, such as metal or con-

Table 2—Performance of Some of Walls Tested

Wall Panel	Test Condition	Condensation in cavity Criterion 1	Condensation on warm surface Criterion 2	Cavity Dew Point Criterion 3	Average Dew Point Criterion 4
1	A	none	none	—	—
	B	none	none	OK	OK
	C	none	none	OK	OK
	D	none	none	OK	OK
1a	C	none	none	OK	OK
	D	none	none	OK	OK
2	A	condensation	—	—	—
	B	condensation	condensation	fail	fail
2a	C	none	condensation	OK	OK
	D	none	condensation	OK	OK
6	A	none	none	—	—
	B	none	none	—	—
6a	C	none	none	—	—
	D	none	none	—	—
7	A	none	none	—	—
	B	none	none	OK	fail
	C	none	none	—	—
	D	none	none	—	—
7a	C	none	none	—	—
	D	none	none	—	—
14	E	none	none	—	—
	F	none	none	—	—
17	E	none	none	—	—
	F	condensation	condensation	—	fail
20	E	none	condensation	—	—
	F	none	condensation	—	—
21	E	none	none	—	—
	F	none	none	—	—
22	E	none	none	—	—
	F	none	none	—	—
23	E	none	none	—	—
	F	none	none	—	—
24	E	none	condensation	—	—
	F	none	condensation	—	—
25	E	none	condensation	—	—
	F	none	condensation	—	—
26	E	none	none	OK	OK
	F	none	none	OK	OK
27	E	none	none	OK	OK
	F	none	condensation	OK	OK
28	E	none	none	OK	fail
	F	none	condensation	OK	OK
29	E	none	none	—	—
	F	none	condensation	—	—
30	E	none	none	—	—
	F	none	condensation	—	—
41	G	condensation	none	fail	fail
	H	condensation	none	fail	fail
41a	H	condensation	none	fail	fail
	I	condensation	condensation	fail	fail
42	G	condensation	none	fail	fail
	H	none	condensation	fail	fail
	I	condensation	condensation	fail	fail
43	G	condensation	none	fail	fail
	H	condensation	none	fail	fail
43a	H	none	none	fail	fail
	I	condensation	condensation	fail	fail
44	G	condensation	none	—	—
	H	condensation	none	—	—
44a	H	condensation	none	—	—
	I	condensation	condensation	fail	fail

crete. Panels frequently met all requirements for satisfactory walls except that condensation occurred on the interior surface near a metal stud, metal sill, or a returned edge of an exterior metal sheet. In other cases, excessive plaster droppings within the wall created a path for high heat transfer and contributed to the formation of condensation on the interior plaster surface.

The advantages of a metal exterior are frequently offset by the undesirable accumulation of condensation. As has been demonstrated on Wall Panel 2, this feature may be overcome in a measure by adequate ventilation from the weather to the wall cavity.

The use of a good vapor barrier well applied on the warm side of the wall is emphasized. Trouble with condensation in the wall cavity was seldom experienced where an effective vapor barrier was properly used. Plywood served as a good vapor barrier, especially if it was painted with several coats of oil paint. The walls having metal panels as the interior finish were very resistant to vapor flow.

The joints between fabricated panels frequently represent an area of condensation. Where bolts or metal strips are used through metal, contact points present a cold surface to the humid air in the heated space. Several panels showed condensation at joints only, whereas the remainder of the panel was suitable for the conditions encountered.

The use of organic materials which encourage the growth of mildew and fungus under favorable conditions is to be discouraged. With relatively short exposures to favorable conditions, such materials show stains and fungous growth.

Acknowledgment

The series of tests described herein were sponsored by the Housing and Home Finance Agency, Washington, D. C. Prefabricated panels were obtained by the Agency in cooperation with the manufacturers of the respective panels. Test conditions and criteria were suggested by R. R. Britton, structural engineer, Housing and Home Finance Agency.

Resistance Gradients Through Viscous Coated Air Filters

By Frank B. Rowley* and Richard C. Jordan**, Minneapolis, Minn.

This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and the Graduate School of the University of Minnesota in cooperation with the Engineering Experiment Station, University of Minnesota

SUMMARY—A method of quantitatively measuring the resistance gradients through unit types of filters having packs of reasonable thickness and of such nature as to be readily severed has been devised. Five different types of filters chosen at random were subjected to five combinations of test dusts and lint and are here reported in nine different tests. The tests reported were chosen as representative of the results to be expected with this type of analysis and are not indicative of a comprehensive test program. The results of these tests are reported as a series of resistance gradient curves through the filtering media at different stages of the tests ranging from the initial unloaded filters to the fully loaded filters with a total resistance of approximately 1 in. of water.

THE performance characteristics of air filters are markedly affected by the type of dust to which the filter is subjected and by the manner in which this dust is distributed throughout the filter. The majority of unit filters of either the viscous or dry type are constructed of a series of layers of filtering medium through which the air-dust mixture must pass. During this process the air entering the filter is split into a series of minute streams of tortuous passage. By virtue of the continually changing direction of these air streams, the heavier dust particles are literally centrifuged from the air onto the surrounding medium.

If the material from which the filter is constructed is closely woven and possesses only extremely fine interstices, most of the dust is eliminated at the initial surfaces, and it then becomes necessary to design a filter with a comparatively thin, usually dry, medium, but with a greatly increased inlet surface area for collection of the dust. This is usually done by *accordion pleating* the medium. The distribution of dust is primarily across the initial surfaces with the resistance drop across the filter kept low by virtue of the large surface area. With such filters, there is evidence to support the theory that the process of dust elimination is still brought about through impingement and centrifuging action, although it appears probable that some of the dust is removed by an actual screening process in the passage of the air-dust mixture through the extremely fine openings.

Viscous or dry filters constructed of coarsely woven layers of material, usually coated with a viscous adhesive, vary in thickness from one to four inches. An attempt is frequently made to grade these layers from coarse to fine, passing from the entering to the leaving surfaces. In some cases, a grading of adhesive has also been attempted with the heaviest coating at the discharge side of the filter. This gradation of fiber size, density, and coating is adopted in an attempt to distribute the dust collected more evenly throughout the filter. The coarse, more thinly oiled entering medium of the filter is the least efficient in removing dust and will therefore collect only the heavier and larger dust particles. The leaving surfaces of denser pack and heavier oiling will be more efficient in collecting the finer, smaller dust particles which are more difficult to remove from the air.

Theoretically this gradation of efficiency should result in a corresponding gradation of dust particle size collected throughout the filter. When properly designed for a specific dust, a filter should possess maximum efficiency, coupled with long life and dust holding capacity. In contrast, a filter constructed without gradation in medium, oiling, or both, will have the same dust removing efficiency at all layers of the medium, and the dust will tend to collect in the initial layers and result in a high, localized resistance at such a section of the filter. It is thus possible to have most of the dust deposited on only a few layers with the rest of the filter practically unused at the time the final limiting resistance drop across the filter is reached.

Measurement of Filter Resistance Gradients

The dust loading of filters at the various sections of the filtering medium is usually determined by examination. However, such a procedure is at best capable of only approximate, and in some cases even faulty conclusions. No true quantitative picture can be obtained by such means.

In order to obtain measurements of the actual resistance gradients through unit filters under various

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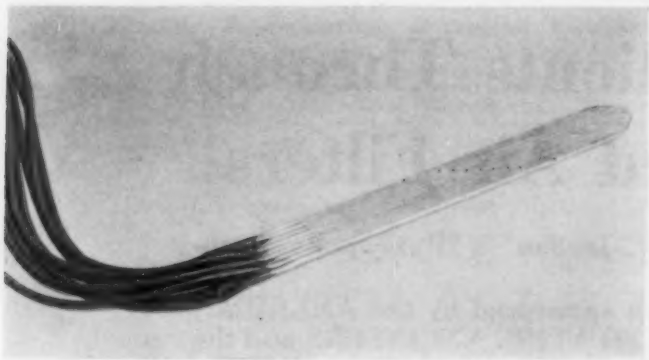
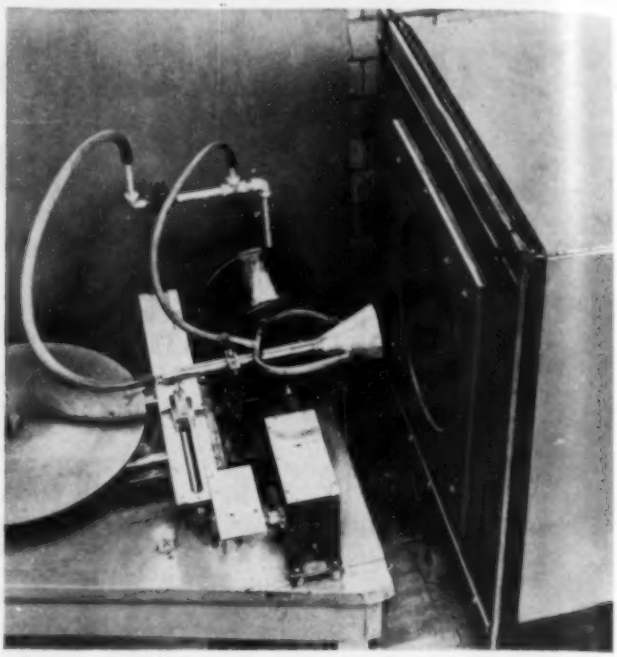




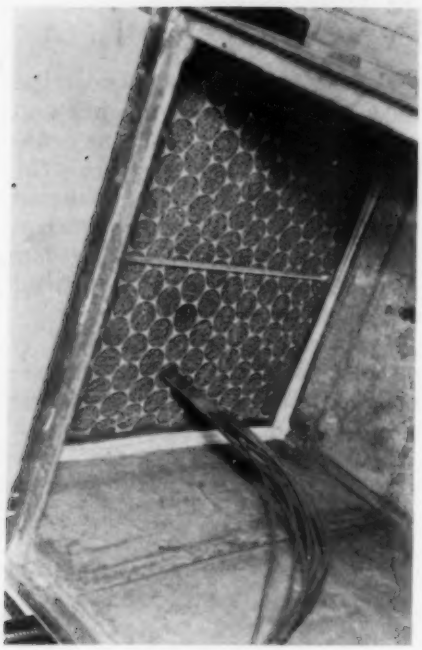


Fig. 1 — Resistance gradient measuring device

Fig. 2 *(left)*—Device positioned in filter

Fig. 3 *(right)*—View of air filter test apparatus dust feeder

conditions of loading, a special measuring device was constructed for use in these tests. This device (Figs. 1 and 2) consists of nine ⅛-in. copper tubes laid parallel to each other with the space between the tubes filled with solder to provide flat surfaces on either side of the pack. These tubes are sealed at one end, with the sealed ends of the tubes arranged to form a point to facilitate insertion into the filter.

Each of the measuring tubes constituting the pack contains a 1/16-in. hole drilled through the side to make possible the measurement of the static pressure at various points within the filtering medium. The first and second holes are spaced ¾ in. apart in the direction of the air flow. The next six static openings are spaced ¼ in. apart; and the last opening is located ¾ in. farther along in the direction of air flow. This spacing was arranged for the measurement of the resistance gradient through a standard 2-in. filter. This makes possible the measurement of the static pressure ½ in. upstream from the entering face of the filter, ½ in. downstream from the leaving face of the filter, and at each ¼ in. through the filtering medium itself.

The open end of each of the measuring tubes is connected by means of a flexible rubber tube to an inclined draft gage for measurement of the resistance gradient. All tubes are continued 2-¼ in. beyond the last opening and 2-¼-in. upstream from the first opening in order to introduce as little turbulence as possible at the points of measurement. The entire device is approximately 9-⅜ in. long, 1-⅛ in. wide, and ⅛ in. thick.

Test Apparatus and Procedure

In order to develop a procedure by which typical resistance gradients through unit filters might be determined under various laboratory test conditions, the weight method of testing air filters was adopted as a basic test. This test apparatus, shown in Fig. 3, has been described in detail together with the test procedure in a previous publication.[1] The apparatus consists essentially of a test duct, 20 in. square and 9 ft long, connected to an exhaust fan by means of a reducing section 3 ft in length and a 12-in. diameter duct 5 ft in length. The test filter is sealed in the square duct approximately 8 in. from the reducing section. A blower is used to draw the air through the filter, and the volume of air is measured by a standard bell-shaped orifice; the total pressure drop across the filter is measured by two piezometer rings connected to a standard inclined water gage.

The dust feeding apparatus shown at the left of Fig. 3 consists of a revolving disk upon which the dust sample has been evenly distributed in a layer of uniform thickness. The disk containing the dust sample is placed on a rotating plate and a continuous, uniform ribbon of dust is shaved from the outside edge of the dust ring by a knife edge fastened to the end of an air suction tube. Air and dust are inducted through this tube by connecting it to a low pressure air jet and venturi tube. Throughout all the tests the filter face air velocity was maintained at 300 fpm and the dust rate

[1] ASHVE Research Report No. 1094—Air Filter Performance as Affected by Kind of Dust, Rate of Dust Feed, and Air Velocity Through Filter, by Frank B. Rowley and Richard C. Jordan. (ASHVE Transactions, Vol. 44, 1938.)

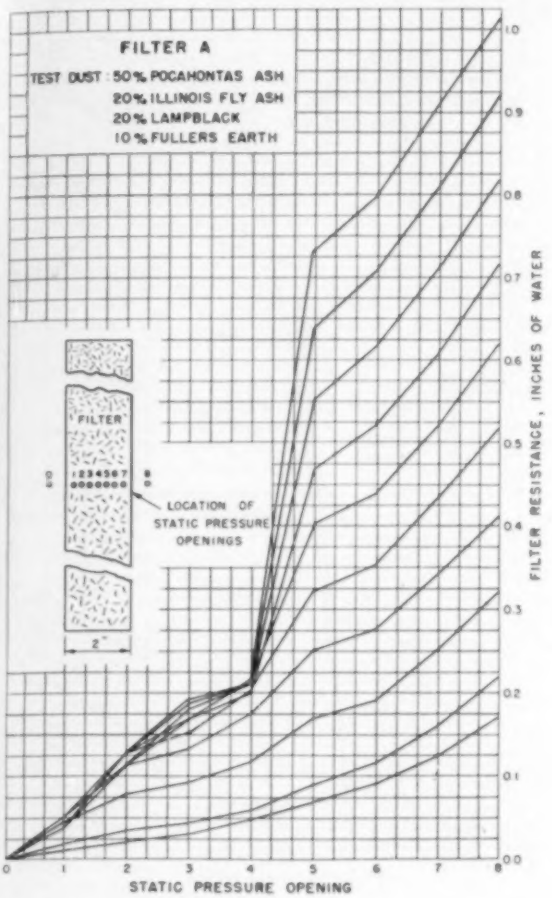


Fig. 4—Resistance gradient curves for filter A
(Test dust: 50-20-20-10 mixture)

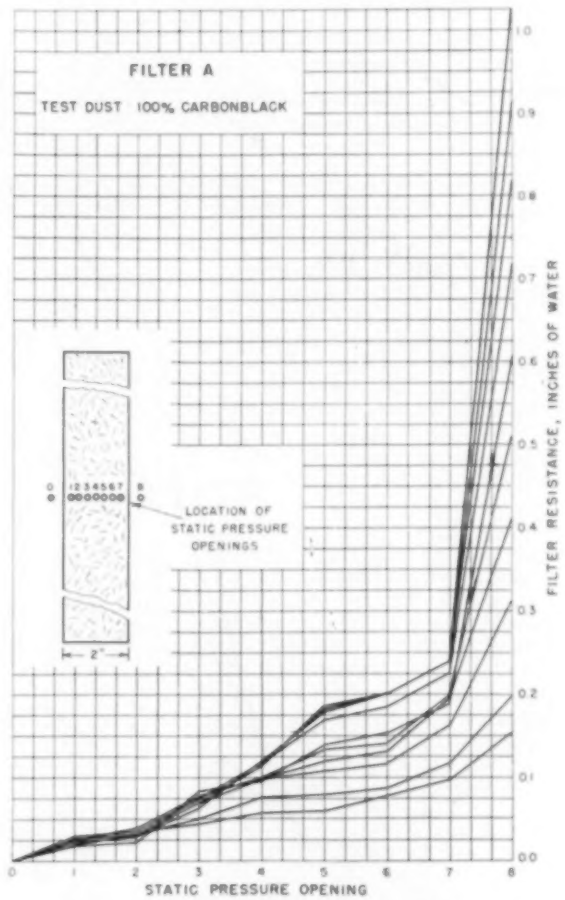


Fig. 5—Resistance gradient curves for filter A
(Test dust: carbon black)

of feed to the filter at either 20 or 40 g (grams) per hour depending upon the test. In all cases, standard determinations were made of the filtering efficiency, life in hours, and the dust holding capacity in grams, with the latter two determinations based upon a limiting resistance of 1.0 in. of water.

In addition to the standard test procedure for determinations of the efficiency, life, and dust holding capacity, resistance gradient measurements were made throughout the tests by the device previously described. It was found that great care had to be exercised in inserting the gradient tube in the filtering medium in order to obtain true values of the resistance gradients. In some cases it was found that the tube could be inserted satisfactorily by merely pushing it through the medium, while in others, it was necessary to sever the medium with a knife before insertion.

It should be emphasized that in any case where a tube, such as the one used in the present tests, is inserted in a medium through which the air is flowing, there are certain to be minor alterations in the nature of the flow. It is likely that at some points there will be at least a partial restriction of the static openings by the surrounding medium. However, it was found that if care was taken in positioning the gradient tube, a remarkably smooth gradient curve could be obtained. The total pressure gradient across the filter, as determined by means of the gradient tube, checked very closely with the total pressure drop as determined by means of two piezometer rings located upstream and downstream of the filter.

In several cases it was necessary to insert the gradient tube through the media at two or three different points before a satisfactory position was located. In all cases if the gradient curve as determined for the unloaded filter prior to starting the test was smooth and indicated no abnormalities, and if the total pressure drop as indicated by the gradient tube checked with the total pressure drop as indicated by the piezometer rings, it was assumed that the position of the tube was satisfactory.

Several tests were conducted in order to determine the effects of lint on filter pressure gradients. The procedure used in such tests was in accordance with that described in a previous paper,[3] and consisted essentially of injecting lint fibers into the test duct by means of a special feeder concomitantly with the feeding of the test dust. In these tests the lint was fed at a rate of 2 g per hour and the dust at a rate of 18 g per hour for a total of 20 g per hour.

[3] ASHVE Research Report No. 1145—The Effect of Lint on Air Filter Performance, by Frank B. Rowley and Richard C. Jordan. (ASHVE Transactions, Vol. 46, 1940.)

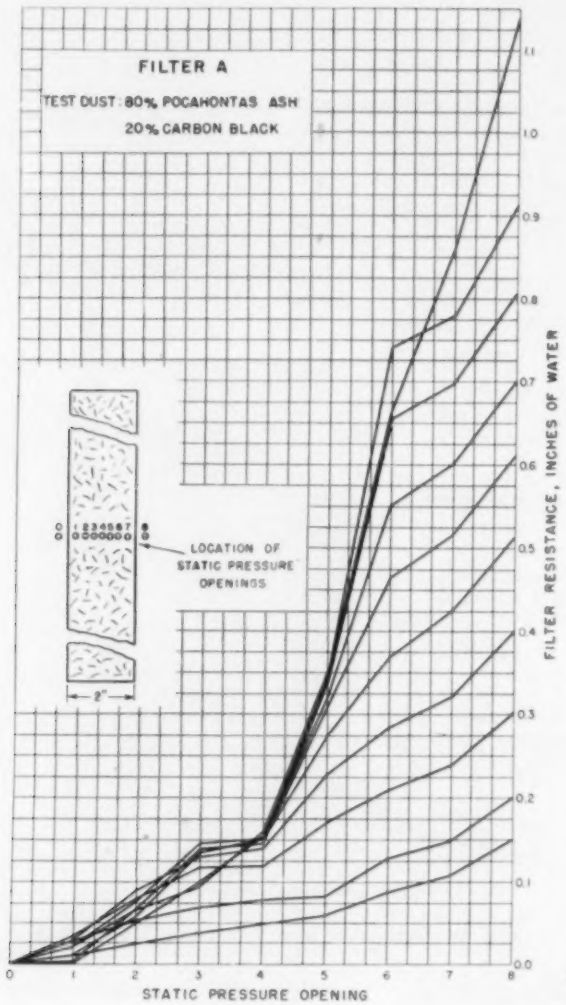


Fig. 6 *(left)*—Resistance gradient curves for filter A
(Test dust: 80-20 mixture)

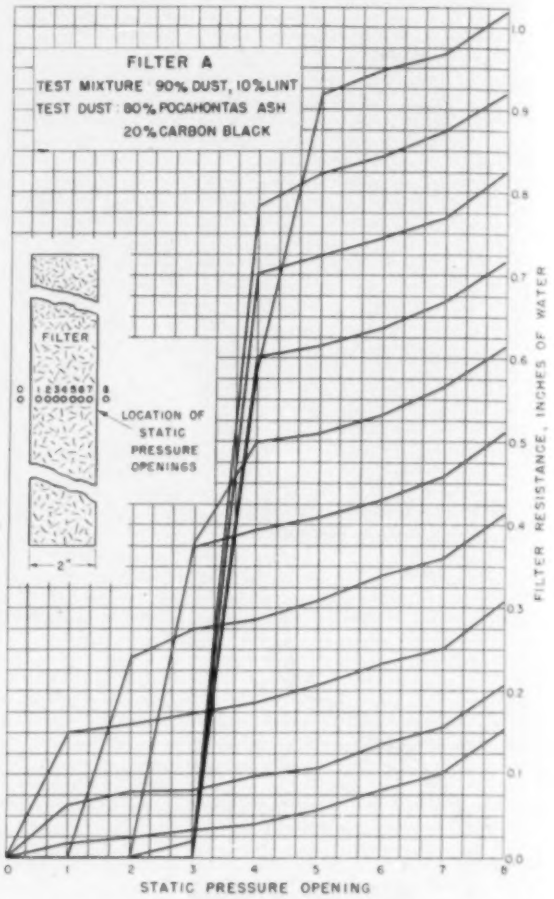


Fig. 7—Resistance gradient curves for filter A
(Test dust: 80-20 dust and lint mixture)

Test Dusts

Since the purposes of the present tests were to develop a procedure for determining pressure gradients through filters and to indicate the effects of various test dusts and loadings upon the resistance gradients and filter performance characteristics, several different artificially synthesized dusts were used. One of these consisted of a mixture of 50 percent by weight of Pocahontas ash screened through a 200 mesh screen, 20 percent by weight of Illinois fly ash screened through a 200 mesh screen, 20 percent by weight of lampblack screened through a 100 mesh screen, and 10 percent by weight of Fuller's earth screened through a 200 mesh screen. This mixture was one of the earliest used in filter testing at the Experimental Engineering Laboratories at the University of Minnesota and was introduced into these tests merely to increase the range of test dusts.

Another mixture used and developed more recently in the University of Minnesota laboratories consisted of 80 percent Pocahontas ash screened through 200 mesh and 20 percent carbon dust[3] screened through 100 mesh. In addition to these two mixtures some tests were run using the carbon black without mixture; other tests used either the 50-20-20-10 or the 80-20 mixture in conjunction with lint. The lint used consisted of Java kapok fibers cut into lengths ranging up to 3/16 in. These fibers, as indicated in earlier publications, reproduced reasonably well, both as to length and to diameter, actual lint fibers removed from commercial and residential filtering installations.

The densities of these test dusts were obtained by tapping containers holding the dust to maximum density and were as follows: Pocahontas ash (200 mesh), 0.77 per cc (cubic centimeter); Illinois fly ash (200 mesh), 0.74 g per cc; lampblack (100 mesh), 0.16 g per cc; Fuller's earth (100 mesh), 0.60 g per cc; K-1 carbon black (100 mesh), 0.48 g per cc.

Test Filters

A comprehensive study of the test dusts on a complete range of the different types of filters available was not attempted, nor were all of the filters chosen tested with each

[3]ASHVE Research Report No. 1218—Overloading of Viscous Air Filters During Accelerated Tests, by Frank B. Rowley and Richard C. Jordan. (ASHVE Transactions, Vol. 48, 1942.)

Table 1—Filter Performance Test Characteristics

Test No.	Type of Filter	Test Dust	Rate of Dust Feed Grams/hr	Avg. Efficiency %	Life, hr[a]	Dust Holding Capacity[a] Grams
1	A	50% Pocahontas ash 20% Illinois fly ash 20% Lampblack 10% Fullers earth	40	89.7	10.0	358.8
2	A	100% Carbon black	20	73.1	32.4	473.8
3	A	80% Pocahontas ash 20% Carbon black	40	90.0	17.0	611.9
4	A	90% Dust 10% Lint	Dust: 18 Lint: 2	92.6	2.6	48.3
	"	Dust { 80% Pocahontas ash 20% Carbon black				
5	B	90% Dust 10% Lint	Dust: 18 Lint: 2	91.5	1.7	31.2
		Dust { 50% Pocahontas ash 20% Illinois fly ash 20% Lampblack 10% Fullers earth				
6	C	80% Pocahontas ash 20% Carbon black	40	79.4	21.3	706.8
7	C	90% Dust 10% Lint	Dust: 18 Lint: 2	83.4	4.5	75.1
		Dust { 80% Pocahontas ash 20% Carbon black				
8	D	Carbon black	40	32.2	66.0[b]	850.8[b]
9	E	90% Dust 10% Lint	Dust: 18 Lint: 2	89.4	3.1	55.5
		Dust { 80% Pocahontas ash 20% Carbon black				

[a]Life and dust holding capacity based on limiting filter resistance of 1.00 in. of water.
[b]Life and dust holding capacity based on limiting filter resistance of 0.87 in. of water.

type of dust. Selection of the filters, of the dusts, and of the tests actually conducted was made only to obtain a range of combinations broad enough to indicate the value of this type of analysis and to indicate typical results which can be expected. Five filters were involved in various tests:

Filter A—a viscous coated, throw-away type filter 2 in. thick. The straight, fibrous medium used in its construction was graded in fiber size, density and oiling from entering to leaving side.

Filter B—a modification of filter A with a curly instead of straight, fibrous medium used in construction.

Filter C—a cellular type filter, 2 in. thick, built in two sections each with the angle of the cells set at 45 deg to the centerline of the duct and 90 deg to each other. The cells on the entering side were of larger dimension than those on the leaving side.

Filter D—a 2 in. thick, throw-away type filter with a light, viscous coating. The filtering medium was wood fiber graded in density but not in size or oiling from entering to leaving side.

Filter E—a 2 in. thick, expanded paper, throw-away filter graded in oiling from entering to leaving side.

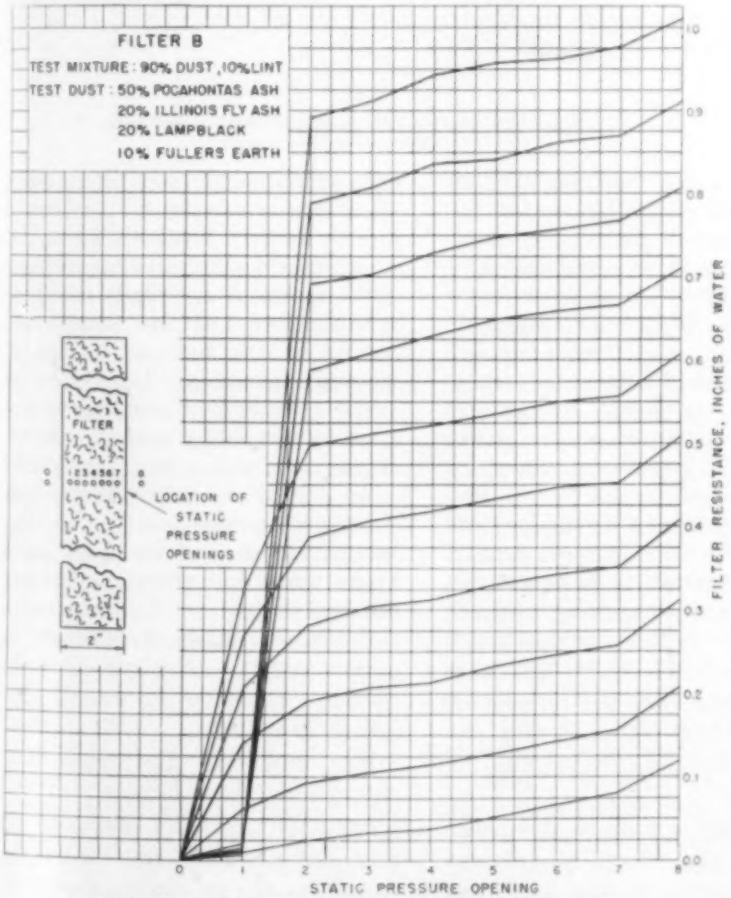


Fig. 8—Resistance gradient curves for filter B
(Test dust: 50-20-20-10 dust and lint mixture)

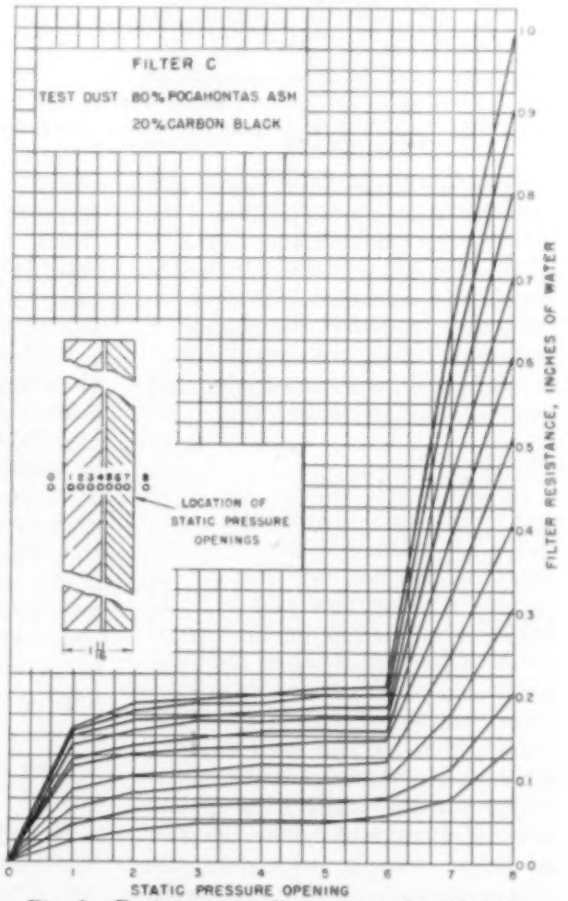


Fig. 9—Resistance gradient curves for filter C
(Test dust: 80-20 mixture)

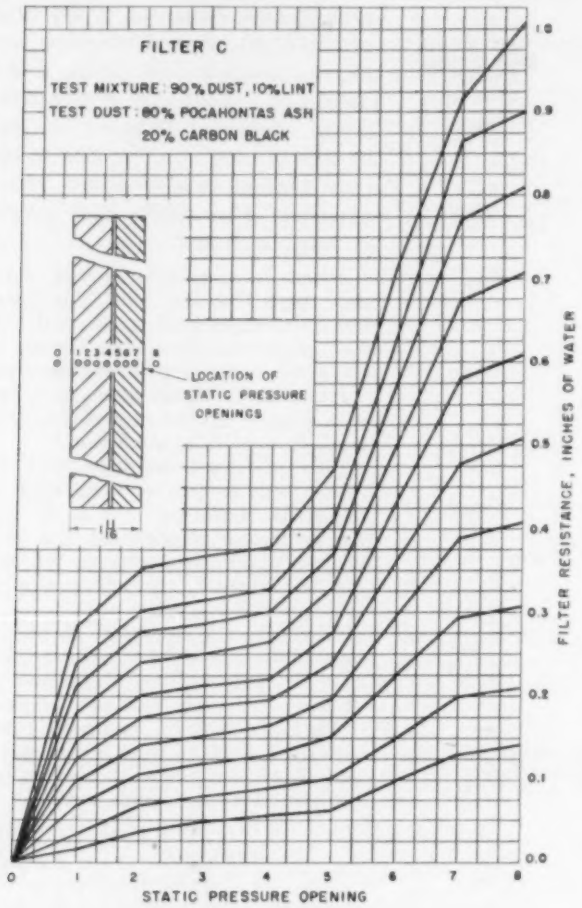

FILTER C
TEST MIXTURE: 90% DUST, 10% LINT
TEST DUST: 80% POCAHONTAS ASH
20% CARBON BLACK
LOCATION OF STATIC PRESSURE OPENINGS
FILTER RESISTANCE, INCHES OF WATER
STATIC PRESSURE OPENING

Fig. 10—Resistance gradient curves for filter C
(Test dust: 80-20 dust and lint mixture)

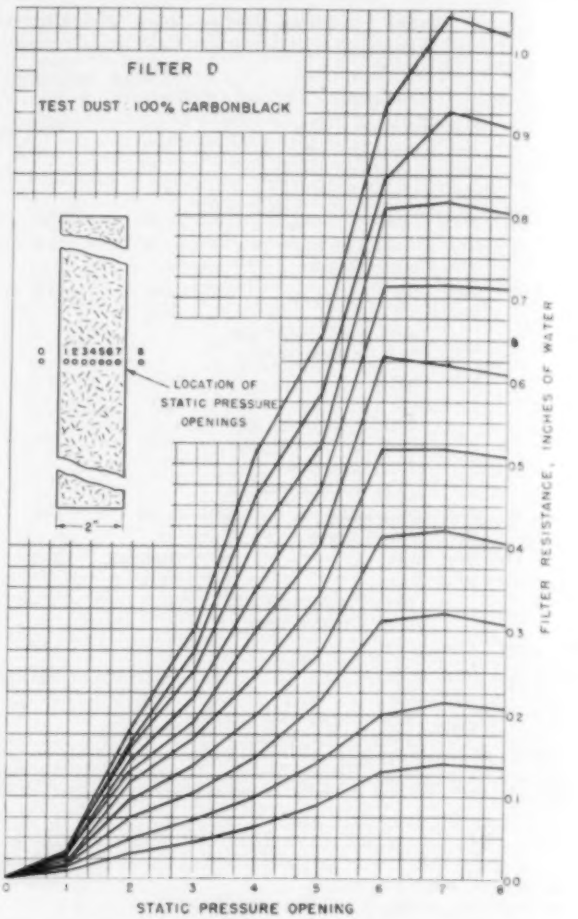


Fig. 11—Resistance gradient curves for filter D
(Test dust: carbon black)

Some of these filters were not standard types readily available on the market. All contained viscous coatings and all were sufficiently thick to permit measurements of the gradient curves. All contained a medium which was readily severed to permit insertion of the gradient measuring device.

Test Results

Typical tests results are presented but with no attempt to provide a comprehensive picture of the effects of any one test dust or the performance of any one type of filter. A tabulation of the conditions under which each test was performed is shown in Table 1 together with the average efficiency, the life in hours, and the dust holding capacity in grams. Data on filter life for the various tests are not directly comparable since the test conditions were prescribed by the best operating conditions to obtain resistance gradient curves.

In some cases the rate of dust feed was 20 g per hour while in others it was 40 g per hour. Doubling the rate of dust feed obviously had the effect of approximately cutting in half the life, in hours, of the laboratory test. The efficiency of the filter for 1 hour of test is the percentage, by weight, of the test dust fed to the filter and eliminated by the filter. The average efficiency is the average of the hourly efficiencies determined throughout the test. The life of the filter is defined as the number of hours of test before an arbitrary limiting pressure drop across the filter, in this case 1 in. of water, is reached. The dust holding capacity is the number of grams of dust collected and deposited in the filter throughout the test life.

No attempt is made in this paper to discuss the effects of different test dusts, rates of dust feed, and other variables upon the performance characteristics of the filters, since this is covered in the literature[1,2,3]. Briefly, however, it may be stated that earlier tests have shown that lint fibers are easily removed by air filters and are usually deposited in the entering layers of filtering medium. Carbonaceous dusts, particularly soot, as simulated by lampblack and to a lesser degree by carbon dust, are much more difficult to eliminate and are usually deposited heavily on the leaving surfaces of the filter pack where the filtering efficiency of the medium is higher. In most cases carbonaceous dusts are difficult to remove and the effect of their use is to lower markedly the overall efficiency of the filter.

Ash dusts of the type used throughout these tests are of intermediate size and difficulty of elimination and are therefore found more generally deposited throughout the filter pack. The pre-

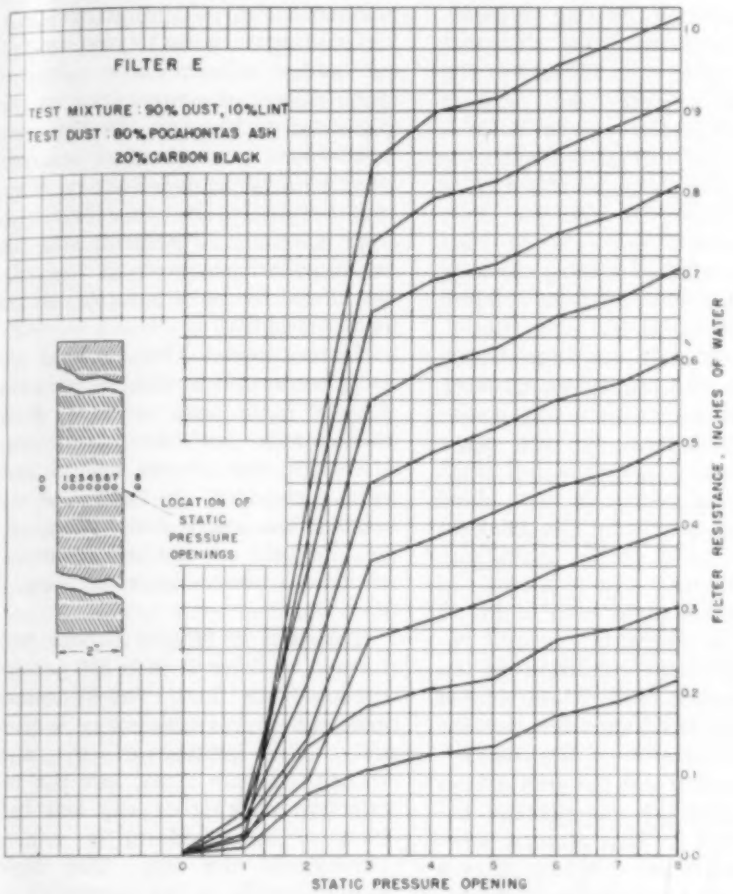

FILTER E
TEST MIXTURE : 90% DUST, 10% LINT
TEST DUST : 80% POCAHONTAS ASH
20% CARBON BLACK
LOCATION OF STATIC PRESSURE OPENINGS
2"
FILTER RESISTANCE, INCHES OF WATER
STATIC PRESSURE OPENING

Fig. 12—Resistance gradient curves for filter E
(Test dust: 80-20 dust and lint mixture)

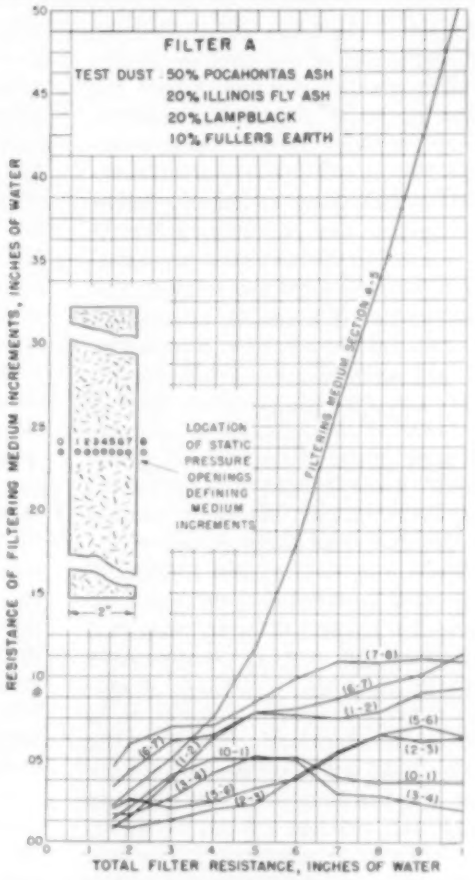

FILTER A
TEST DUST : 50% POCAHONTAS ASH
20% ILLINOIS FLY ASH
20% LAMPBLACK
10% FULLERS EARTH
LOCATION OF STATIC PRESSURE OPENINGS DEFINING MEDIUM INCREMENTS
2"
FILTERING MEDIUM SECTION 6-7
RESISTANCE OF FILTERING MEDIUM INCREMENTS, INCHES OF WATER
TOTAL FILTER RESISTANCE, INCHES OF WATER

Fig. 13—Resistance of filtering medium increments vs. total filter resistance (filter A)
(Test dust: 50-20-20-10 mixture)

dominant factor involved in the difficulty or ease of elimination is the particle size itself. The heavier and larger particles, such as lint or large dust particles, are more easily centrifuged and impacted against the oiled surfaces, whereas the finely divided carbonaceous dusts of small particle size possess a lower momentum and follow the tortuous passages through the filter more easily. Furthermore, the larger particles with greater mass have a much greater effect per particle on determinations of efficiency based on weight than do small particles. A 10 micron diameter particle, for example, is much easier to eliminate than a 1 μ (micron) diameter particle, yet the larger particle has a weight equivalent to approximately 1000 of the smaller units.

Figs. 4 through 12 present the filter resistance gradient curves for all tests reported. Positions 0 through 8 plotted as the abscissa on these curves represent the nine positions of the static pressure openings on the resistance gradient measuring device shown in Fig. 1. The actual position of each of these static openings with relation to the filter is shown on the insert in each of these drawings.

Positions 0 and 8 were external to the filter, and the pressure drop between these two positions therefore represents the total filter pressure drop. The resistance, as shown at each of the intermediate points from 1 through 7, indicates the pressure drop to that point within the filter. The curve with the lowest total pressure drop on each figure indicates the initial resistance gradient through the filter before the test had started. The curve showing the greatest pressure drop represents the final resistance gradient through the filter at the end of the test or at approximately 1 in. of water total resistance. Each of the intermediate curves represents the pressure gradients through the filter in total resistance increments of approximately 0.1 in. of water. Since it was difficult to stop the test at the exact 0.1 in. increment, the intersections of these curves with the scale at position 8 do not coincide exactly with the scale increments. The slope of each pressure gradient curve between any two positions on the abscissa indicates the filter resistance rate of increase within that increment of distance. Thus, if the slope is low, there is little resistance in that section of the filter, whereas if the slope is high, the resistance is correspondingly great.

For filters A, B, and C, the initial resistance gradient curves indicate a higher slope at the latter layers of the filtering medium. This would be accounted for by any attempt to make the leaving layers more efficient by providing a denser pack or oiling. The initial resistance gradient curve for filter D indicates a

reasonably constant pack throughout the depth of the medium except toward the latter layers where the slope decreased, probably indicating a somewhat lighter pack or oiling. The ineffectiveness of this section of the pack is further borne out by the lack of any appreciable dust loading or increase in resistance in this section as the test progressed. The initial resistance gradient curve for filter E indicates a reasonably constant pack. In several, but not all, cases, a marked increase at some point on the resistance gradient curve for the unloaded filter indicated a section of the filter where excessive loading of the dust was likely to occur.

Tests Nos. 1, 2, 3, and 4 (Figs. 4, 5, 6, and 7) were all performed on filter A with four different test dust mixtures. In test 1 the smoothly increasing initial resistance gradient curve gave no indication as to where the heaviest loading of the dust would occur by the end of the test. By the time the total pressure drop had reached 0.5 in. of water, the resistance gradient curve still indicated a good distribution of the dust throughout the filter. However, from this point on, the dust loading in section 4-5 increased with a corresponding increase in the gradient slope. At the end of the test, over 50 percent of the total pressure drop occurred in section 4-5. Test No. 2 (Fig. 5) also on filter A, was made with 100 percent carbon black as the test dust. Since this dust is relatively difficult to remove from the air, it would be expected that the heaviest loading would occur in the latter sections of the filter. This proved to be true, and at the end of the test more than 70 percent of the total pressure drop occurred in the last quarter inch of the filter pack.

In Test 3 (Fig. 6) made on filter A with a mixture of 80 percent Pocahontas ash and 20 percent carbon black, the heaviest portion of the loading occurred between sections 4 and 8. However, the resistance gradient curve at the end of the test indicated a more even loading of the dust than for any of the other tests on filter A. It would therefore be expected that the life and dust holding capacity performance characteristics for this test would be better than for any of the other tests on this filter. This is borne out by reference to Table 1. Although the average efficiency is slightly lower than for test 4, it is not appreciably so, and the filter life (corrected for rate of dust feed) and the dust holding capacity were greater than for tests 1, 2 and 4 on the same filter.

Test 4 (Fig. 7) on filter A was performed with a lint-dust mixture. The filtering efficiency was somewhat higher than for the other tests on filter A since the lint fibers formed a mat which, in turn, aided in filtering the dust. The heaviest loading occurred on the initial surfaces of the filter also as a result of this lint mat. Reference to Fig. 7 indicates a somewhat erratic resistance gradient condition as the test progressed, with a shifting of the sections of maximum resistance toward the interior of the filter.

At the end of test the greatest resistance gradient was reached between 3 and 5. This picture, however, is somewhat fictitious since a very marked compression of the filtering medium occurred during the test. It was noticed that in almost all tests as the filter loaded there was a slight compression of the medium so that the final thickness was somewhat less than the initial thickness. Normally, this compression was not more than 5 percent of the total initial thickness of the filter pack. However, in this test the initial heavy loading on the inlet surfaces of the filtering medium resulted in a total compression of 0.81 in. or 40.5 percent of the total thickness. The resistance gradient measuring tube was fixed in position relative to the leaving surfaces of the filter but was allowed to shift relative to the entering surfaces. Thus, the shifting gradient curves throughout the test indicate a continuing compression of the filtering medium rather than a shifting of the dust and lint load within the filter. At the end of the test the static opening at position 3 had actually emerged from the medium.

Test No. 5 (Fig. 8), performed on a modified form of filter A with a somewhat different filtering medium and again with 10 percent lint in the test mixture, also indicated some degree of compression of the pack during the test. In this case again, most of the loading occurred at the initial surfaces of the filter, and the degree of compression was approximately 20 percent with the static opening at position 1 emerging from the medium toward the end of the test.

Tests 6 and 7 (Figs. 9 and 10) were performed on filter C, with the first of these tests using an 80-20 dust mixture, and the second using the same mixture but with 10 percent lint added. In each case the loading was heaviest and the gradient steepest at the points of entrance to the cellular sections of the filter.

Test No. 8 (Fig. 11) was performed on filter D with 100 percent carbon black dust. The resistance gradient curves indicate a reasonably good loading of the dust throughout the filter, but the ineffective packing of the last half inch of the medium is evident throughout the test. The slight negative slope to the gradient lines toward the leaving side of the filter is probably a result of inaccuracies inherent in the method of measurement.

Test No. 9 (Fig. 12) on filter E was performed with an 80-20 dust mixture and 10 percent lint. Again, the pronounced increase in the resistance gradient at the entering surfaces caused by the loading of lint is evident. In this case, no compression whatsoever of the medium occurred and the gradient curves are therefore comparable for each position throughout the test.

In Fig. 13 the data of Fig. 4 are regraphed with the resistance of each quarter-inch layer of filtering medium plotted against the total resistance of the filter. These data would take the same general form if the resistance of each layer of the pack were plotted against time. This method of presentation shows quite clearly how, after the test is partially completed, the dust deposits in one particular layer will become heavier than in other sections of the filter; once this process

has started, the resistance gradient at this point becomes progressively steeper. When heavy loading has started at some particular layer the condition becomes progressively worse as the additional load of dust in that section forms an increasingly efficient area of high resistance into which more and more dust will be deposited. In this case, if the life of the test had been defined by a limiting resistance of 0.4 in. of water, this condition would have been avoided. However, when high limiting resistances are allowed, the condition indicated in Fig. 13 will almost certainly occur at some section, dependent upon the design of the filter and the type of dust to which the filter is subjected. Similar curves may be plotted for the other tests shown in Table 1 and Figs. 4 through 12.

Conclusion

The test results indicate that heavy loading of the dust in the filtering medium frequently occurs at some point of one-quarter to one-half inch in depth. The location of this localized high resistance gradient will vary depending upon the nature of the filtering medium and the test dust. Lint normally deposits towards the entering surfaces of the filter and therefore causes localized high resistance gradients at this point. Finely divided carbonaceous dusts deposit more heavily in the more efficient dust filtering areas usually located toward the discharge side of the pack and cause high localized resistance gradients in such sections. Other dusts and mixtures cause steep gradients at intermediate sections.

Any abnormally high localized gradient encountered in the initial unloaded filter may cause excessive initial deposits at this point, and this in turn may eventually result in an extremely steep gradient within a very small depth of the filter. Conditions were encountered in which, at the end of test, as much as 75 percent of the total resistance of the filter could be attributed to localized resistance within a quarter-inch depth of the filtering medium. It is apparent that once a condition of a high localized resistance gradient has developed within a filter, the dust deposits in this section become progressively heavier and in turn result in progressively steeper gradients at this section.

This type of analysis is suggested as a laboratory and possibly a field test. It is evident that, if filters are designed which are not inherently susceptible to the establishing of localized high resistance gradients, the performance characteristics, particularly the life and dust holding capacity of the filter, can be materially improved.

Texans Ready to Welcome ASHVE Members to 56th Annual Meeting, Exposition in Dallas

January 22-26, 1950

THE Texas Specials, Rockets and Zephyrs, will bring several thousand members, guests and ladies to the 56th Annual Meeting of the ASHVE and the Southwest Air Conditioning Exposition in Dallas during the fourth week of January 1950.

The meeting headquarters will be in the Hotel Adolphus and the Baker Hotel and early arrivals will find the Registrations Desk open on Sunday morning, January 22nd. Because of the number of committee meetings and the technical sessions, the facilities of both hotels will be used so that the program should be checked for the location of daily events. The Committee on Arrangements headed by C. Rollins Gardner has sent a special message to members saying that the Reception Committee hopes that "you all will remember your trip to Texas" and further states that "some of you all will never forget it." The Committee has been in Conference with the Chamber of Commerce so as to assure the best brand of weather for the fourth week in January.

Technical Papers to Be Presented

The Program and Papers Committee, of which Reg. F. Taylor, Houston, is chairman, has selected some interesting subjects for the technical sessions including the use of night air for cooling, heat pump performance, panel heating and cooling, condensation on walls, effective temperature index studies, and baseboard radiation performance. The program gives full details.

A great number of committees will have meetings—the Council meets January 22.

One of the important items of business will be the vote on the new By-Laws which have been streamlined to provide more effective administration and operation. Copies have been mailed to members for study. These new By-Laws represent two years of work by the Constitution and By-Laws Committee.

There will be a meeting of Chapter Delegates to choose members of

the Nominating Committee and discuss chapter operating problems.

Inspection Trips Planned

The time not required for sessions will be available for plenty of diversion for both members and ladies. Inspection trips are scheduled, and those desiring to go should sign up at the Registration Desk. The ladies will have a Get-Acquainted Session on Sunday, a luncheon and style show Tuesday, and a theater party Wednesday afternoon.

A Chuck Wagon dinner will be served Monday night and the Annual Banquet will be held Wednesday night. Reservation forms for all events have been sent to members, and it will be helpful to the committee if they are returned promptly.

As a post-meeting feature, a trip to Mexico City has been arranged and full details of this tour will be sent to those who plan to attend the meeting.

A special train on the Frisco-MKT will leave St. Louis at 5:30 p.m. Saturday, January 21st, and will carry special cars from New York, Washington, Cincinnati, Cleveland and Chicago. Arrival in Dallas is scheduled for 7:30 a.m. Sunday.

Dallas Museum of Fine Arts

Air Conditioning Exposition

A large attendance is indicated for the Southwest Air Conditioning Exposition which will be housed in two buildings at the Fair Grounds. Bus service from the downtown hotels will be available at frequent intervals. The Society will have booth space to show visitors the value of membership, its publications and research activities. All space in the two buildings has already been allotted.

According to plans made there will be approximately 200 displays by manufacturers of heating, air conditioning, and ventilating equipment. Many exhibitors are incorporating research results into their products. One example of such design is that of building panels which are 3¼ in. thick but which, when used for exterior walls, are said to have a heat transmission factor better than a 12 in. masonry wall with furred plaster interior surface. These panels are used for roofing as well as for side walls.

Other products planned for display are heat absorbing plate glass and other types of glass for protection against the sun's light and heat. Other types of insulation, coverings and types of board will also be shown.

Ease and flexibility of installation will be emphasized in packaged air conditioners, heating systems, furnaces, burners, steam boilers and motors which will be on display, as well as furniture-styled room heaters, radiant panels and baseboard heating units. The newest type of replaceable air filter made of glass will also be displayed. A motor designed especially for the air conditioning industry will be exhibited. This motor is designed to run in an atmosphere of Freon gas. An all-weather type of motor which may be washed down with a hose and which will withstand adverse weather conditions will also be featured. The exposition is managed by C. F. Roth and E. K. Stevens.

ON TO MEXICO!!

Post-Meeting All-Expense Tour by Rail *or* Air for ASHVE Members and Friends

By Rail: Lv. Dallas 11:00 p.m., MKT, Friday, January 27, visiting San Antonio, en route to Mexico City.

By Air: Lv. Dallas 6:00 p.m., Friday, January 27 (American Airlines) visiting Acapulco, en route to Mexico City.

Tour Will Include:

1. Two-day motor drive of 185 miles to lovely Cuernavaca and unique Taxco.
2. One-day motor trip to the Guadalupe Shrine and the famous pyramids of Teotihuacan.
3. City Trip of Mexico City to points of interest and the famous Floating Gardens of Xochimilco.
4. Two-day trip to world-famous Acapulco, the "Riviera of the Americas." (Only for those traveling by Air)
5. Accommodations at deluxe hotels throughout.
6. Sightseeing in chauffeur-driven private cars with English speaking drivers.
7. Baggage handling throughout the trip, including tips for group handling of same.
8. Leave Mexico City, February 3, by Rail at 8:00 a.m.; and by Air at 10:00 a.m. for return trip.
9. Literature and detailed schedules will be furnished upon application and all reservations will be handled by the United States Travel Agency.

PROGRAM — ASHVE 56th Annual Meeting — Dallas, Tex.

Hotel Adolphus and The Baker Hotel

January 22-26, 1950

Sunday—January 22

10:00 a.m. RECEPTION & REGISTRATION (Mezzanine—Baker)

10:00 a.m. Committee on Research (Baker)
Council (Adolphus)

2:30 p.m. Ladies Get-Together (Texas Room—Baker)

4:30 p.m. Chapter Delegates (Adolphus)

Monday—January 23

8:30 a.m. REGISTRATION (Mezzanine—Baker)

9:30 a.m. FIRST SESSION (Ballroom—Baker)
- Call to Order
- Greetings
- Response by Alfred E. Stacey, Jr., President
- Reports of Officers and Council
- Night-Air Cooling, by F. E. Giesecke
- Physiologic Examination of the Effective Temperature Index, by Nathaniel Glickman, Tohru Inouye, R. W. Keeton, M. K. Fahnestock
- Amendment of By-Laws

10:30 a.m. Ladies Assembly (Texas Room—Baker)

12:30 p.m. Welcome Luncheon (Ballroom—Adolphus)

2:30 p.m. Opening of Exposition at State Fair Grounds

2:30 p.m. Chapter Delegates (Adolphus)

7:00 p.m. Chuck Wagon Dinner — Entertainment — Dancing

Tuesday—January 24

9:00 a.m. REGISTRATION (Mezzanine—Baker)

9:30 a.m. TECHNICAL SESSION (Ballroom—Adolphus)
- Report of Tellers of Election
- Thermodynamic Criteria for Heat Pump Performance, by John F. Sandfort
- Evaluating Heat Pump Performance, by F. R. Ellenberger, A. B. Hubbard, W. R. Foote, F. Burggraf, J. J. Martin, Jr.
- Condensation on Prefabricated Walls, by E. R. Queer and E. R. McLaughlin

12:30 p.m. Luncheon Meeting (Adolphus)

12:30 p.m. Ladies Luncheon and Style Show (Mural Room—Baker)

2:00 p.m. Chapter Delegates (Adolphus)

6:30 p.m. Past Presidents' Dinner (Adolphus)

Wednesday—January 25

9:00 a.m. REGISTRATION (Mezzanine—Baker)

9:30 a.m. TECHNICAL SESSION (Ballroom—Adolphus)
- Solar Heating of Houses by Vertical South Wall Storage Panels, by A. G. H. Dietz and Edward Czapek
- Removal of Lighting Loads by Panel Cooling, by Merl Baker
- Baseboard Radiation Performance in Occupied Dwellings, by G. S. MacLeod and C. E. Eves

1:45 p.m. Leave Hotel Baker—Ladies Theater Party—Margo Jones presents: My Granny Van

2:00 p.m. TECHNICAL SESSION—(Ballroom—Adolphus)
- Report of Committee on Research
- Panel Heating Research Report on Experimental Techniques and Results of Heat Flow Within a Concrete Panel and Heat Flow Analysis for Buried Pipes
- Effect of Panel Location on Skin and Clothing Surface Temperature, by L. P. Herrington and R. J. Lorenzi

7:00 p.m. ANNUAL BANQUET (Ballroom—Baker)

Thursday—January 26

9:00 a.m. REGISTRATION (Mezzanine—Baker)

10:00 a.m. TECHNICAL SESSION (Ballroom—Adolphus)
- Resistance Gradients Through Viscous Coated Air Filters, by F. B. Rowley and R. C. Jordan
- Fitting Losses for Extended Plenum Forced-Air Systems, by H. H. Korst, N. A. Buckley, S. Konzo, R. W. Roose
- Vaneaxial Fan Fundamentals, by Raymond Mancha
- Unfinished Business
- New Business
- Resolutions
- Installation of Officers
- Adjournment

12:30 p.m. Nominating Committee Luncheon (Adolphus)

12:30 p.m. Council Luncheon (Adolphus)

Committee on Arrangements

C. Rollins Gardner, *General Chairman*
G. A. Linskie, *Vice Chairman*

Honorary Chairmen
F. E. Giesecke — Reg F. Taylor

Banquet—M. L. Brown, *Chairman;* J. P. Dillard, J. R. Dowdell, W. E. Frost, E. J. Stern.

Entertainment—R. E. Allison, *Chairman;* A. B. Carter, V. C. Kneese, James O'Connor, Jr., A. A. Stone, J. L. Tye.

Exposition—Oslin Nation, *Chairman;* W. R. Barbeck, S. S. Brandt, N. R. Collins, Jr., F. L. Gray, Jr., R. G. Lyford.

Finance—E. T. Gessell, *Chairman;* J. B. Lowe, J. F. Marshall, R. R. Matthews.

Ladies—T. H. Anspacher, *Chairman;* R. R. Brient, Jr., R. A. Mixon, J. D. Poythress. *Assisted by:* Mmes. T. H. Anspacher, J. P. Ashcraft, W. R. Barbeck, Herman Blum, Jr., M. L. Brown, J. F. Dillard, C. Rollins Gardner, E. T. Gessell, D. C. Kieffer, V. C. Kneese, G. A. Linskie, Oslin Nation, J. A. Ray, P. N. Vinther.

Publicity—J. P. Ashcraft, *Chairman;* D. L. Echols, E. J. Hatzenbuehler.

Reception—W. R. Barbeck, *Chairman;* S. E. Ammons, A. F. Avera, J. A. Bishop, M. W. Brown, H. M. Cunningham, E. E. Farrow, D. W. Harrington, T. M. Jones, R. C. Knight, B. W. Levy, C. H. McLeod, M. J. Murray, H. G. Walcott, K. L. Wilson.

Sessions—P. N. Vinther, *Chairman;* J. W. Lacy, D. C. Pfeiffer, R. A. Walker.

Special Events—Herman Blum, Jr., *Chairman;* R. M. Burgess, Fred Downs, R. A. Mayes, I. P. Newby.

Transportation—J. A. Ray, *Chairman;* C. F. Gilmore, M. O. Tessman, Jr., C. C. Young.

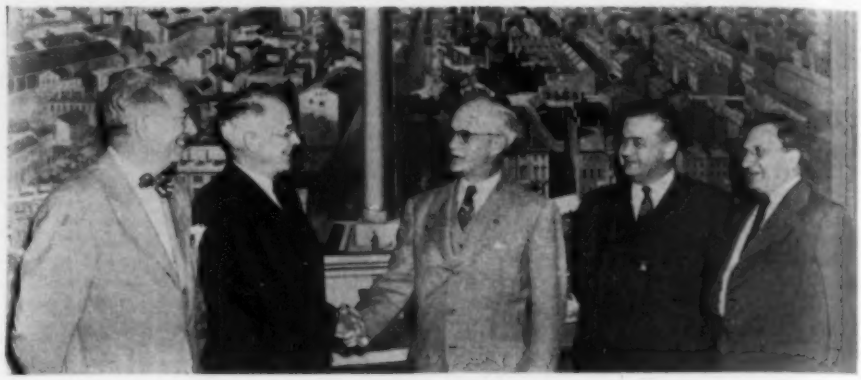
EMINENT SOCIETY MEMBERS ATTEND CHARTER MEETING OF BALTIMORE CHAPTER

Four past presidents of the ASHVE were guest speakers and several other prominent Society members participated in the Charter meeting of the Baltimore Chapter which was held in the Lord Baltimore Hotel, Baltimore, Md., October 17, 1949.

Opening the meeting, which was attended by more than 100 persons, E. L. Crosby, president of the Baltimore Chapter, welcomed the visitors on behalf of the new Chapter and introduced A. E. Stacey, Jr., president of the ASHVE. President Stacey gave the response as spokesman for the national membership and introduced the 1949-50 officers of the Society as follows: Lester T. Avery, first vice president, Cleveland, Ohio; L. E. Seeley, second vice president, Durham, N. H.; Ernest Szekely, treasurer, Milwaukee, Wis.; and A. V. Hutchinson, secretary, New York, N. Y. President Stacey also introduced the speakers of the evening who were four ASHVE past presidents.

G. L. Tuve, junior past president of the Society, having served in 1948, spoke on research as a general view. Research can be done in many fields, Mr. Tuve said, including a survey of one's own possibilities.

M. F. Blankin, Philadelphia, Pa., whose term in 1943 gave him the distinction of being one of the youngest presidents of the Society, spoke on *Membership and Public Relations*. Mr. Blankin also presented a Life Membership certificate to Louis G. Vance in recognition of his having been a member of the Society for 30 years.



Society officers congratulate Baltimore chapter president—*(l. to r.)* Lester T. Avery, 1st vice president, ASHVE; A. E. Stacey, Jr., president, ASHVE; E. L. Crosby, president, Baltimore chapter; L. E. Seeley, 2nd vice president, ASHVE; and Ernest Szekely, treasurer, ASHVE

Homer Addams, New York, N. Y., charter member and president of the ASHVE in 1924, described the early meetings and struggles of the ASHVE during its beginnings in 1894-95. Mr. Addams occupies a unique position among Society members in that he participated in the organization of the Society.

W. H. Driscoll, Jersey City, N. J., president of the ASHVE in 1926, spoke on the subject *The Society's Aims and Activities*. Reviewing the years of the Society's growth through good times and bad, he predicted a great future for it. He then presented the Charter to Mr. Crosby who received it on behalf of the Baltimore Chapter.

Prominent guests at the dinner meeting included: A. W. Edwards, Cincinnati, Ohio, chairman of the Chapter Delegates Committee of the Society; T. F. Rockwell, Pittsburgh, Pa., chairman, Admission and Advancement Committee; Cyril Tasker, director of research of ASHVE, Cleveland, Ohio; C. F. Roth and E. K. Stevens, both of the International Exposition Co., New York, N. Y.

W. H. Driscoll, ASHVE past president *(left)* presents the charter to E. L. Crosby with G. B. Priester looking on

E. L. Crosby *(left)* and G. B. Priester holding the charter of the new Baltimore chapter →

Louis G. Vance *(left)* receives Life Membership certificate from M. F. Blankin, ASHVE past president

Council members who attended were: three year Council members—Spencer W. Boyd, Atlanta, Ga.; C. Rollins Gardner, Dallas, Tex.; J. Donald Kroeker, Portland, Ore.; and C. O. Mackey, Ithaca, N. Y. Two year Council members—D. M. Allen, Kansas City, Mo.; F. A. Hamlet, Montreal, Que.; C. S. Leopold, Philadelphia, Pa.; and H. E. Sproull, Cincinnati, Ohio. One year Council members—C. F. Boester, W. Lafayette, Ind.; Reg. F. Taylor, Houston, Tex.; G. L. Tuve, Cleveland, Ohio; and L. N. Hunter, Ex-Officio, Johnstown, Pa.

PRESIDENT STACEY HONORED AT CENTRAL NEW YORK MEETING

Several distinguished figures in the heating and ventilating field were present at the Central New York chapter meeting held in Syracuse, October 4, 1949. Attended by 72 persons, the meeting was the initial one for the 1949-50 season, with A. E. Stacey, Jr., president of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, as guest of honor.

President Stacey spoke on the organization and operation of the ASHVE and discussed a few of the problems confronting the Society and the manner in which these problems can be handled. He impressed the members and guests with the surprising growth of the Society and its many contributions to the art and science of heating, ventilating and air conditioning.

A longtime friend and associate, W. H. Driscoll, past president of ASHVE, made the introduction of President Stacey and described the ASHVE president's many activities in the Society.

A get-together before the Central New York Chapter meeting. *(l. to r.)* V. S. Day, Dr. W. H. Carrier, A. E. Stacey, Jr., Dean Louis Mitchell, W. H. Driscoll

Other distinguished guests were as follows: Dr. W. H. Carrier, chairman emeritus, board of directors, Carrier Corp. and past president of the ASHVE; Mrs. W. H. Carrier; Dean Louis Mitchell, College of Applied Science, Syracuse University; L. L. Lewis, vice president, Carrier Corp., and past president of the *American Society of Refrigerating Engineers;* A. D. Sullivan, 2nd vice chairman, Central New York Chap-

Central New York Chapter opens its season with President Stacey as guest speaker

ter, *ASRE;* Warren Lawrence, president, Technology Club, and Howard Wynn, president of the *New York State Professional Engineers Society.* Introduction of the guests was made by V. S. Day, president of the Central New York Chapter, who presented a chapter past president's pin to D. L. Mills.

Summary of Chapter Meetings*

• CINCINNATI—October 4, 1949. The responsibility of the air conditioning engineer in providing air for healthful living was pointed out by Lester T. Avery, first vice president of ASHVE, who spoke before Chapter members gathered jointly with the *ASRE.* Mr. Avery stated that the air conditioning engineer should cooperate with the medical profession in defining the quality of air which should be prescribed. He emphasized that more time and effort should be extended to provide better heating and air conditioning systems for the comfort and health of the public.

In charge of the program was W. J. Killian, program chairman, who introduced the speaker. K. B. Little, president of the chapter, gave the official welcome to members and guests in this first meeting of the year 1949-50. It was pointed out, however, that the ASHVE annual Fall Roundup had been held September 22 with golf, baseball and dinner featured in the entertainment. Attendance 52. Attendance ratio 0.41.

• CONNECTICUT—October 13, 1949. Presentation of the Life Membership certificate of William Forsberg was made by Winfield Roeder, president of the Chapter, at the meeting in Hartford. W. A. Johnson accepted the certificate for Mr. Forsberg, who was unable to attend.

Dwight Douglas, superintendent of the Hartford Electric Light Co., was the speaker of the evening. Prior to the dinner meeting, an inspection trip was made to the South Meadows plant of the company, and Mr. Douglas reviewed this trip and gave details pertaining to the equipment. He also answered questions from the audience.

The Nominating Committee was elected as follows: R. W. Sidbury, chairman; W. A. Johnson, F. L. Hausser, J. R. Smak, and C. F. Ganter. Reports were given by the chairmen of the membership and meetings committees and by the treasurer. It was announced that the next meeting would be held November 10 in Bridgeport with Carl F. Boester, member of ASHVE Council, as the speaker. Attendance 64. Attendance ratio 0.52.

• DELTA—October 11, 1949. A number of subjects of interest to the heating and ventilating engineer were taken up at the meeting in New Orleans, with C. E. Blome, manufacturer's representative, Lafayette, Ind., speaking on *The Functions and Problems Involved in Venting Gas Fired Appliances.*

G. E. May, chairman of the Chapter research committee, reported on the solar research work of the University of Illinois at Urbana, Ill., and Tulane University, New Orleans. Mr. May also reported on the progress made in air conditioning in Southern Schools.

Walter Cooke, legislative committee, gave a report on the city building code. A letter of greetings was sent to the new ASHVE Chapter in Baltimore by Pres. R. B. Guest. Ralph Elizardi, vice president of the Chapter, presided over the meeting. Attendance 39. Attendance ratio 0.37.

• GOLDEN GATE—October 6, 1949. The principles involved in electrostatic precipitation were demonstrated by the speaker, J. W. May, technical director, Air Filter Division of the American Air Filter Co., Inc., Louisville, Ky., who addressed the meeting in San Francisco.

It was announced by the program committee chairman that the November meeting would feature a talk by J. Donald Kroeker, Portland, Ore., member of ASHVE Council, who will address the chapter on heat pump applications. Because of the interest in this subject, the *ASRE* has been invited to attend.

Reports were given by the chairmen of the membership and finance committees. Other reports were given by J. E. Murray and C. H. Bazille. Attendance 80.

• ILLINOIS—October 10, 1949. During the meeting held in Chicago, two speakers were heard on building construction and maintenance.

Connecticut Chapter launches its 1949-50 season

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

The speakers were W. A. Stahl, operating manager of the Merchandise Mart, and G. R. Bailey, member of the *National Association of Building Owners and Managers* and manager of Albert H. Wetten & Co., real estate firm. Mr. Stahl discussed maintenance problems in large buildings, such as the Merchandise Mart and the Montgomery Ward & Co. building in Chicago, and explained the problems of maintenance and supervision in small towns as compared with those in large cities. He indicated that for buildings currently being designed one must consider the subject of future maintenance. Of all maintenance problems, he pointed out, heating and ventilating equipment require most attention. An interesting example of the importance of intelligent maintenance was the fact that the cost of changing an individual bulb in the Merchandise Mart amounts to 30 cents. By scheduling changes at an estimated 80 percent of bulb life, this cost has been dropped to 10 cents.

Mr. Bailey spoke on problems of new construction, including personnel and operation, and discussed operating costs in loft type buildings as compared with larger units. He also pointed out some of the more definite problems concerning the advantages of air conditioning systems from the point of gross rental returns and the possibilities of increasing the full floor area by eliminating light and air shafts as a result of air conditioning. Attendance 162. Attendance ratio 0.34.

• IOWA—October 11, 1949. At the meeting in Des Moines, N. H. Curry brought out the interesting point that as far back as 1865 quite a bit of material was available on the heating and ventilating of livestock shelters. Mr. Curry is assistant professor and research agricultural engineer of the Agricultural Experiment Station, Iowa State College, Ames.

W. E. Petersen was appointed chairman of the membership committee. Members were appointed to the following committees: *Legislative*—J. F. Sandfort, C. A. Wheeler, Perry LaRue; *Entertainment*—C. A. Wheeler, D. C. Murphy, C. W. Helstrom; *Short Courses*—M. E. Gould, chairman, D. E. Schroeder, R. S. Stover, H. W. Holbrook, C. A. Wheeler, T. H. Smoot. Guests of the meeting were introduced by Mr. Sandfort. Attendance 29. Attendance ratio 0.68.

• KANSAS CITY—September 12, 1949. A Life Membership certificate was presented to W. E. Gillham by D. M. Allen, member of Council, at the meeting in Kansas City in the Roof Garden of the Aladdin Hotel.

Water for Air Conditioning was the subject presented by M. P. Hatcher, director of the Water Department of Kansas City, Mo. Introduced by Vice Pres. W. E. Howarth, Mr. Hatcher gave a stimulating talk, followed by one of the most lively discussion periods in recent meetings.

C. C. Lillis of the Southern Oil Co. gave a talk on community welfare. H. E. Degler reported on local publicity. W. K. Dyer, chairman of the student branch committee, gave a report on relations of the Kansas City Chapter with the Student Branch of the University of Kansas in Lawrence. A note of thanks was received from Mr. and Mrs. L. T. Mart in acknowledgment of the chapter's sympathy for the loss of their son.

A report by S. A. Durbin on the Fall Party was read by Henry Nottberg, Jr. Preparation of the new chapter roster was reported by C. W. Schumacher, secretary. Attendance 52.

• MANITOBA—October 20, 1949. A discussion of heavy oils was given by H. R. MacKenzie, combustion engineer, Imperial Oil, Ltd., at the October meeting in Winnipeg. Mr. MacKenzie outlined the use, methods of preheating and relative efficiency of the oils and compared them with various types of solid fuels.

G. E. Randall was named alternate of the Chapter Delegates Committee. J. R. Stephenson, past president of the Chapter, introduced the speaker. The report of the program committee was given by A. W. Moss, president. A report of the Christmas party committee was made by C. M. Fleming, chapter secretary. Attendance 18.

• MANITOBA—September 22, 1949. Cooperation was the keynote of the address by L. Green, senior partner in the firm, Green-Blankstein-Russell and Associates, before the Manitoba Chapter in Winnipeg. Mr. Green spoke about architecture and the relation of engineers to the architect.

A resolution was passed appointing Pres. A. W. Moss to represent the Chapter as delegate to the Annual Meeting in Dallas in January.

D. F. Michie was appointed publicity reporter. The report of the Board of Governors meeting dealing with the schedule for future meetings was read and approved. A method of presenting the past presidents' pins was also described. Attendance 20.

• MASSACHUSETTS—October 18, 1949. J. Donald Kroeker, a member of ASHVE Council and consulting engineer in Portland, Ore., spoke on larger heat pump applications before the initial meeting of the 1949-50 season of the Massachusetts chapter held in Cambridge. Mr. Kroeker discussed the heat pumps in the Equitable Building and the Oregonian Publishing Co. Building, both in Portland. Mr. Kroeker pointed out that high coefficients of performance were obtained because of the use of "by-product heat" or heat rejected through large interior areas which required cooling. The coefficients of performance obtained, said Mr. Kroeker, were from 14 to 22. It was pointed out that the Equitable Building in Portland had a heat pump system of 340 tons capacity and the Oregonian system had 550 tons capacity.

Pres. W. H. Shipp welcomed members and guests and reminded the audience of the coming meeting of

the *ASTM* on Solar Heating. Attendance 65. Attendance ratio 0.50.

• MICHIGAN—October 17, 1949. *Sound Control and Air Distributing Systems* created a great deal of interest at the meeting held in Detroit. This subject was presented in the form of a paper by T. A. Walters, director of research, American Blower Corp., Detroit.

Mr. Walters described present sound tests for fans, indicating that these do not show true noise levels within duct systems. He emphasized, however, that "generally the sound level is lowest at the peak efficiency of the fan, so the fan should be selected at the point of maximum efficiency. The quietest fan can generally be selected in the upper ranges of capacity shown on a typical fan catalog page."

Principles of applying acoustical materials as duct lining for sound absorption were discussed also by Mr. Walters, who explained that the amount of material needed is related to duct length, area, and perimeter.

Reports by various committee chairmen were given as follows: *Meetings*—C. F. Donohoe; *Finance*—G. W. Akers; *Reception*—G. L. Davis, Jr.; *Membership*—E. F. Glanz.

Pres. L. A. Burch reviewed the work of the chapter in establishing the Student Branch at the University of Detroit and confirmed the appointment of a committee to assist the Student Branch. This committee consists of E. F. Hyde, C. F. Donohoe and J. B. Olivieri. President Burch also announced the dates for the Refresher Courses for those wishing to take the examination for the Michigan Professional Engineering Certificate. Attendance 61.

• NEW YORK—October 17, 1949. The use of steam for air conditioning was the subject of the talk given by B. A. Dmitrieff at the initial meeting of the 1949-50 season held in New York City. Mr. Dmitrieff, who is construction superintendent, Consolidated Edison Co., New York City, gave the history of the use of steam for refrigeration in steam jet and absorption systems. He explained that the economic use of any type of system could be determined only by careful analysis of all of the factors involved. Several original installations of steam jet systems, the speaker said, were still operating economically and were equalling the performance of centrifugal machines. According to the speaker, the use of steam for refrigeration in New York had now reached a consumption of 230,000,000 lb annually, or the equivalent of 20,800 tons of refrigeration.

In the absence of Membership Chairman C. S. Koehler, C. W. Stewart presented the names of 35 new chapter members. Pres. H. S. Johnson presided over the meeting and announced the appointment of the program committee as follows: R. L. Stinard, *chairman*, H. S. Birkett, Jack W. Booker, A. A. Giannini, and C. H. Flink. The following committee chairmen were also appointed: *Christmas Party*—Bernard Leventhal; *Reception*—C. B. Albright; *Membership*—C. S. Koehler. Attendance 100. Attendance ratio 0.19.

• NORTH TEXAS—September 19, 1949. The development of today's electrostatic precipitator was described by Christian Savitz of the Air-Maze Corp., Cleveland, Ohio, at the meeting in Dallas. Mr. Savitz gave a brief history of the precipitator and described its applications involving atmospheric dust. The equipment currently available was described in detail. Introduction of the speaker was made by W. B. Watterson, sales engineer of the Air-Maze Corp.

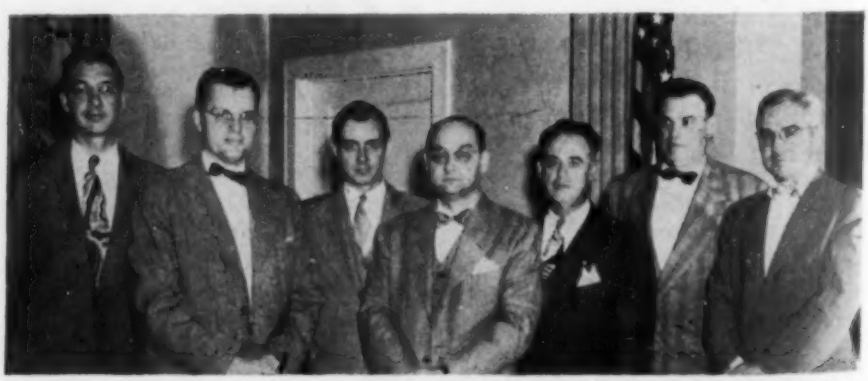
The business part of the meeting was taken up with a discussion of chapter membership. Attendance 107. Attendance ratio 0.59.

• NORTHEASTERN OKLAHOMA—October 4, 1949. Guests at the meeting held in Tulsa included Prof. Robert Irwin and 14 members of Oklahoma A & M. It was announced that a letter had been written by Pres. W. R. Lee on behalf of the chapter congratulating the Baltimore chapter upon its organization.

The development, present status and future outlook of heating and ventilating research of the ASHVE Research Laboratory were described by Cyril Tasker, director of ASHVE research, Cleveland, Ohio, who was guest speaker of the evening. Attendance 34. Attendance ratio 0.35.

• NORTHEASTERN OKLAHOMA—September 13, 1949. Zeph Marsh spoke on *Trends in Automatic Controls* at the meeting in Tulsa. Mr. Marsh is from the Oklahoma City office of the Minneapolis-Honeywell Regulator Co.

A Nominating Committee was appointed as follows: R. E. Pauling, *chairman*, R. E. Brown, and C. H.



Northern Ohio 1950 Chapter Officers *(l. to r.)* John Richmond, Board of Governors; W. M. Rowe, Vice President; G. V. Parmelee, Secretary; R. L. Byers, President; W. R. Moore, Board of Governors; R. E. Sherman, Treasurer; D. E. Mannen, Jr., Board of Governors

Dollmeyer. Pres. W. R. Lee announced the speakers for the next four meetings and also spoke briefly regarding the Society's 56th Annual Meeting to be held in January 1950, in Dallas. Attendance 26. Attendance ratio, 0.50.

• **NORTHERN OHIO**—October 10, 1949. A special feature of the October meeting held in Cleveland was the presentation of a Life Membership certificate to H. M. Nobis. The presentation was made by Lester T. Avery, first vice president of the ASHVE. In an acceptance speech, Mr. Nobis compared the activities of the Society in 1914, the year of his entrance, with those of the present year. *Foundry Mechanization* was surveyed by C. O. Bartlett, vice president and sales manager of the Bartlett & Snow Co. Mr. Bartlett displayed slides which showed conveying equipment, sand heating equipment and various installations for collecting fumes and dust at shakeout and pouring stations. The collector for eliminating dust at the discharge from cupola stacks was also shown. Mr. Bartlett pointed out the relationship between the sales philosophy and the engineering viewpoint.

The coffee speaker was Mr. Avery, who gave an interesting summary of problems being considered by the ASHVE Council. The resignations of P. D. Gayman, C. A. McKeeman, and F. A. Hancock were accepted with regret by the chapter. Vice Pres. W. M. Rowe reported on the status of the chapter roster. Other reports were given by the following: *Financial*—R. E. Sherman; *Membership*—R. E. Leising; *Publicity*—L. C. McClanahan.

Program Chairman R. W. Dickson stated that H. E. Degler, technical director, The Marley Co., would speak at the November 14 meeting on *Cooling Towers and Water Conservation*. H. F. Hebley, director of research, Pittsburgh Consolidation Coal Co., will speak at the December 12 meeting on the subject *Atmospheric Pollution*. Attendance 66.

• **NORTHERN OHIO**—September 23, 1949. The Northern Ohio Chapter informally opened its 1949-50 season with its annual fall golf party at Pine Ridge Country Club. In spite of threatening rain and high winds, about 40 participants in the ancient Scottish game turned in creditable scores, with the top scores as follows: T. A. Weager, Jr.—low gross; Walter Rieger—low net; and W. F. D. Neiheiser—low putts.

After an excellent dinner, Pres. R. L. Byers presided at a brief informal meeting and announced plans for the coming year. Credit for a successful party was given to the entertainment committee under the chairmanship of Mr. Weager. The meeting then adjourned for a social hour.

• **OKLAHOMA**—October 5, 1949. *The What and Why of ASHVE Research* was the subject chosen by Cyril Tasker, director of ASHVE research, Cleveland, Ohio, at the meeting held in Oklahoma City. Mr. Tasker spoke about the work going on at the Society's Research Laboratory and also gave a summary of past achievements in research, such as the development of comfort standards and design data. Presiding officer at the meeting was H. S. Shafer, president of the chapter. Attendance 21. Attendance ratio 0.28.

• **ONTARIO**—October 3, 1949. A topic of great importance to members and guests at the meeting in Toronto was the conversion of electric energy as described by H. H. Leeming. Mr. Leeming, who is director of frequency conversion, Hydro-Electric Power Commission of Ontario, spoke on *How the Hydro Frequency Conversion Will Affect Heating and Ventilating Equipment*. This changeover in power frequency is affecting almost every chapter member, and Mr. Leeming was asked many questions regarding the solution of various problems.

H. H. Angus was presented with a Life Membership certificate by E. G. Spall. Mr. Angus spoke briefly on the growth and activity of the Ontario Chapter over the past 20 years. An announcement regarding the Society's 56th Annual Meeting was made by J. H. Fox, and Pres. A. J. Strain announced that the Ontario Chapter would be host for the Semi-Annual Meeting in 1950. Attendance 114. Attendance ratio 0.40.

• **OREGON**—September 16, 1949. The purpose of the city codes was explained by Ormond Bean, City Commissioner of Portland, at the first meeting of the 1949-50 season held in Portland. Another guest was Rear Admiral Ramsey, U.S.N., retired. Admiral Ramsey, who is making a study of hydro-electric power in the Pacific northwest, was introduced by his brother, W. P. Ramsey, ASHVE member.

A report was given by A. N. Hoss regarding the cooperative research program proposed for Oregon State College, Corvallis. Pres. J. P. McDermott announced that the new chairman of the membership committee is Dick Blankenship, who replaces K. N. Flocke. Mr. Blankenship then reported on the membership. The Chapter picnic which was recently held was described by A. H. Bohren, chairman of the entertainment committee, who said that the shortage of sandwiches was due to some overly hungry horseshoe pitchers.

A report of the special committee of the chapter was read by C. W. Brissenden, with the recommendation that an air conditioning conference be held in alternate years, the next conference being in 1951. This committee's report was accepted by the Chapter. Attendance 51.

• **PITTSBURGH**—October 10, 1949. The heating and air conditioning of railroad cars were described by V. Dale Wissmiller, supervisor, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. at the meeting in the Fort Pitt Hotel. Mr. Wissmiller showed slides of the early days of

heating and of the development of heating to the present day. A history of controls down to the present electronic control was also given.

A report of the golf meet held recently between the *ASRE* and the ASHVE was made by J. L. McCann. The ASHVE won the match this year. The captain of the *ASRE* team presented the cup to the captain of the ASHVE team. The officers of both groups were introduced. The presiding officer was Pres. H. J. Kirkendall. Attendance 82.

• **ROCKY MOUNTAIN**—October 11, 1949. The uses and applications of glycol vapors were discussed by J. W. Kelly, Jr. at the first meeting of the 1949-50 season in Englewood, Colo. Mr. Kelly, vice president, Air Purification Service, Inc., told how these vapors were discovered and developed for reducing infectious and airborne germs. One of the glycols, he pointed out, had been used as a dehumidifying agent in a bank ventilating system in New York, with a drop in the absentee rate of employees to 2 percent instead of 5 percent. From this original use in humidity control arose the research and experimentation which have made possible the use of glycol vapors for air purification.

During the business part of the meeting, the chairmen of the various committees reported as follows: *Finance*—A. W. Cooper; *Publicity and Public Relations*—P. W. Young. A letter from the ASHVE Committee on Research was read. Attendance 52. Attendance ratio 0.25.

• **SHREVEPORT**—October 13, 1949. A social hour and dinner preceded the meeting of the chapter in Shreveport, La. The *What and Why of ASHVE Research* were explained by Cyril Tasker, director of ASHVE research, Cleveland, Ohio, who was guest speaker of the evening. L. C. Haas spoke regarding a round table discussion on air conditioning and ventilating problems and it was decided to poll the chapter regarding a subject for discussion. Four student members of Louisiana Polytechnic Institute, Ruston, La. were present at the meeting.

A nominating committee was elected for the purpose of selecting chapter officers for 1950. The nominating committee consists of Paul O. Rottmann, B. E. Segall, Sr., W. E. FitzGerald, temporary chairman, S. W. Beaty, and C. A. Frey.

• **SOUTH TEXAS**—September 16, 1949. A talk on precipitation of atmospheric dust with demonstrations received close attention from the membership at the meeting in Houston. The talk was given by Christian Savitz, vice president, Air-Maze Corp., Cleveland, Ohio, and included an outline of the development of electrostatic precipitation from the days of Leyden, Sir Oliver Lodge and other pioneers. Mr. Savitz emphasized that much remained to be learned about the removal of dust from an air stream or enclosure.

Introduction of the speaker was made by W. B. Watterson, sales engineer, Air-Maze Corp. and the program was in charge of Program Chairman R. H. Wittbold.

During the business part of the meeting, B. P. Fisher announced that C. E. Blome would speak on *Venting Modern Gas Appliances* at the meeting on September 30. A. A. Rasmussen reported on the research on air conditioning system control. C. C. Quin reported on the 56th Annual Meeting to be held in Dallas. Attendance 72. Attendance ratio 0.28.

• **SOUTHERN CALIFORNIA**—October 19, 1949. The architect's viewpoint was brought out at the meeting in Beverly Hills by George Allison of Allison & Rible, an architectural firm in Southern California. Mr. Allison, a member of *AIA*, discussed the relationship of the architect to the engineer, equipment supplier, contractor and owner.

A. J. Hess presided as moderator of the panel discussion which followed the speaker's talk. The following participated: Robert Bartlett, mechanical engineer of Bartlett & Berky; Paul Bradfield, equipment representative of F. J. Heartz Co.; Frank Hess, heating contractor of E. Willardson Co.; D. C. Evans, owner's representative from I. Magnin Co.; and A. J. Hess, Hess, Greiner & Polland.

An unexpected treat was the showing of a sound film photographed in color entitled *The Axivane Fan*. Raymond Mancha, vice president, Joy Mfg. Co., was present and answered several questions concerning the design, manufacture and application of this type of fan.

A report summarizing the National Air Pollution Symposium to be held November 10-11 was made, and members were invited. Attendance 85.

• **SOUTHWEST TEXAS** — October, 1949. Work of the Research Laboratory was outlined by Cyril Tasker at the meeting held in San Antonio. Mr. Tasker, Director of ASHVE Research, Cleveland, Ohio, discussed the *What and Why of ASHVE Research*, and invited members to visit the Society's Laboratory in Cleveland.

L. S. Pawkett reported on the progress of the plans for the 56th Annual Meeting to be held in Dallas in January, 1950. Additional information on this meeting was given by C. C. Quin, Houston, a member of the South Texas chapter.

A Nominating Committee consisting of the following was appointed: A. J. Rummel, R. W. Barnes and L. N. Mathis. Attendance 40.

• **WASHINGTON, D. C.**—October 12, 1949. Air contamination existing in industrial cities was the theme of the talk given by Lester T. Avery, First Vice President, ASHVE, before the first meeting of the 1949-50 season. Mr. Avery stressed the importance of pure air and asked that engineers cooperate with the medical profession in establishing standards for pure, healthful air. He stated that the health aspect should be taken into consideration

Washington, D. C. Chapter officers greet Lester T. Avery, guest speaker. ***(l. to r.)*** **J. G. Muirheid, Secretary; R. S. Dill, Past President; Mr. Avery, 1st vice president of ASHVE, P. R. Achenbach, President; R. L. Bridgman, Treasurer**

along with the comfort aspect of the atmosphere.

G. R. Walz was elected to the Board of Governors to fill a vacancy caused by the resignation of John Everetts, Jr. Pres. P. R. Achenbach made a brief announcement concerning the chapter delegate. A nominating committee consisting of Mr. Walz, H. H. Hill and L. H. Holder was appointed. The new committee chairmen were then presented, as well as Chapter members serving on Society committees. R. S. Dill introduced the speaker. An invitation to attend the Charter meeting of the new Baltimore chapter was presented to the group.

• **WESTERN MICHIGAN**—October 10, 1949. The first meeting of the 1949-50 season was held in Grand Rapids, with J. L. Alexander calling the meeting to order at 7:30 p.m. L. A. Calcaterra, secretary, reported on the annual meeting held at Gull Lake Country Club last May.

Past president H. W. Wolters was presented with a plaque by Dean L. G. Miller, Michigan State College, East Lansing, Mich. Prof. C. H. Pesterfield, chapter delegate, gave a report on the summer meeting held in Minneapolis. K. E. Robinson, chapter vice president, reported on the Board of Governors meeting held last August and asked members to specify the type of meetings and speakers desired for the coming season. A motion was made and approved to change the December 5 meeting to December 12. The meeting was rounded out with entertainment in the form of a movie and cider and doughnuts. Attendance 73. Attendance ratio 0.36.

• **WISCONSIN**—September 19, 1949. Practical aspects were emphasized in the talk on radiant heating given before the chapter meeting in Milwaukee by C. W. Colby, executive vice president and director of the Thermex Corp. Mr. Colby described radiant heating systems from small residential types to the largest system which is in Kankakee, Ill. The practical aspects pointed out included the length of piping circuits, the pumping heads, heat loads near large glass exposures, the type of tubing, the size of tubing, perimeter insulation and various heat sources. L. C. Plaehn introduced the speaker and announced that special guests at this meeting were members from the *Wisconsin Association of Architects* and from the Junior and Senior Wisconsin branches of the *Heating, Piping and Air Conditioning Contractors National Association.*

A description of the work of the Chapter Delegates Committee, ASHVE, was given during the dinner meeting by J. R. Vernon. F. J. Nunlist, Jr., program committee chairman, gave a tentative outline of the program scheduled for the 1949-50 season and reported that the October meeting would be held in Racine. An inspection tour during the afternoon of the same day was scheduled at the plant of S. C. Johnson & Son Co., Racine. Attendance 95.

STUDENT BRANCHES

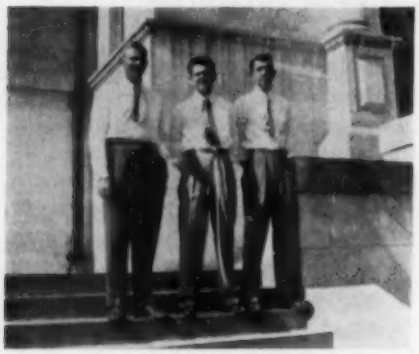
▲ **DETROIT**—October 4, 1949. Three speakers appeared before the meeting of the Student Branch held at the University of Detroit. L. A. Burch, president of the Michigan Chapter, welcomed the interest of the students in the profession and told of the opportunities now open to engineers of heating and ventilating. He also gave a brief history of the ASHVE and its services. E. F. Hyde, a past president of the Michigan Chapter, spoke regarding programs for the Student Branch meetings. C. F. Donohoe invited the Student Branch members to attend the meetings of the Michigan Chapter and summarized plans for the coming year.

Two student members were elected to represent the branch in the Engineering Council of the University of Detroit. They are W. N. Walch and D. J. Hall. Attendance 22. Attendance ratio 0.60.

▲ **N. C. STATE**—October 26, 1949. A business meeting was held by North Carolina State College Student Branch in Page Hall on the campus at Raleigh, N. C. This was a special meeting in which various membership and local matters were discussed. Presiding officer was J. J. Andrews, president. Attendance 29.

▲ **N. C. STATE**—October 4, 1949. North Carolina State College Student Branch held its first meeting of the 1949-50 season in Page Hall, Raleigh, N. C. with emphasis on plans for the future. Features of programs to be presented during the year were discussed. Prof. C. A. McKeeman was elected to the Board of Governors to succeed Prof. L. L. Vaughan. Attendance 25.

▲ **OSC**—October 10, 1949. Pres. M. B. Larson called the meeting of the Oregon State College Student Branch to order in Dearborn Hall, Corvallis, Ore. He summarized the program that is planned for the year. The plan includes general



University of Texas Student Branch Officers *(l. to r.)* D. S. Belvin, president; A. G. Allen, vice president; G. G. Marwill, secretary

talks, field trips, and talks by specialists. J. Donald Kroeker, a member of ASHVE Council and consulting engineer in Portland, Ore., gave a talk on the background and history of THE GUIDE, and also on various Society topics. Vice President J. P. Schenck discussed a plan of the Oregon State College Student Branch for studying THE GUIDE in conjunction with the Oregon Chapter. It was decided to hold the meeting on the first Wednesday after the first Tuesday of the month. Attendance 15.

▲ PURDUE—October 5, 1949. Baseboard heating and its advantages and disadvantages were discussed by S. E. Fenstermaker, Jr. at the first meeting of the school year of 1949-50 held at Purdue University, W. Lafayette, Ind. Mr. Fenstermaker named wall smudge and the expense of the system as two of the disadvantages. The main advantage of the system, he pointed out, is the small temperature difference between the air at the floor and at the ceiling, and the elimination of drafts. In this respect, baseboard heating approaches radiant heating. The loop system of circulation of the heating medium, said Mr. Fenstermaker, makes installation uncomplicated and the usual method of calculating the heating load as shown in THE ASHVE GUIDE is used.

Introduction of Mr. Fenstermaker was made by P. D. Bailey. Chairman of the meeting was C. M. Sallman. Attendance 75. Attendance ratio 0.88.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 179 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 20, 1949, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

BIBB, W. V., Student-Engr., Stanley Engineering Co., Muscatine, Iowa. PROPOSERS: J. F. Sandfort, M. E. Gould. SECONDERS: D. E. Schroeder, Perry La Rue.

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PERSONALS

N. W. Snyder, assistant professor of mechanical engineering at the University of California, has joined the staff of Santa Fe Tank and Tower Co., Los Angeles, as chief technical consultant. Professor Snyder presented a paper on cooling towers during the 55th Annual Meeting last January.

T. M. Cunningham has joined the staff of the *Heating, Piping and Air Conditioning Contractors' Chicago Association*, Chicago, Ill. Mr. Cunningham was formerly Director of Industrial Relations, Carrier Corp., Syracuse, N. Y.

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Best Wishes

for

A MERRY CHRISTMAS

and a

PROSPEROUS and HAPPY

NEW YEAR

DONORA DISASTER DISCUSSED AT *APHA*, SMOKE MEETINGS

Two views of the cause of the Donora smog disaster last year were presented at two different meetings which took place during the week of October 24, 1949 in New York, N. Y. At the 77th Annual Meeting of the *American Public Health Association*, James G. Townsend, M.D., a speaker at the Association's air sanitation session on October 28, stated that a combination of factors and substances led to the Donora disaster.

On the other hand, F. M. Van Deventer, consulting engineer of the Walworth Co., New York, N. Y., speaking on the same day during the Fuel Oil Panel of the Public Education Conference on Smoke Abatement, suggested that a single compound, carbon monoxide, was responsible for the 20 deaths and countless illnesses that resulted a year ago.

Dr. Townsend's talk at the public health meeting was based on the report, "Investigation of an Unusual Smog Incident in Donora, Pa. and Vicinity." He stated that the common factor in the deaths was the pre-existence of diseases of the respiratory system, and that the investigators, including himself, had many problems to overcome during the survey of conditions.

Recommendations of the survey are: plants should reduce gases, particularly sulfur dioxide; a weather forecast program should be established to warn the vicinity of unusual temperature, wind and humidity conditions. Dr. Townsend stated that the effect of living in an industrial area demands further research and that such research opens up a major field in public health.

First entitled "Seeing the Invisible," Mr. Van Deventer's talk was changed to "Who Done It." Mr. Van Deventer said that during the several days preceding the disaster in October 1948, 430 tons of carbon monoxide were poured into the air in 24 hours, largely by a blast furnace. This quantity of carbon monoxide gave a concentration of 8 parts in 10,000, which exceeds the dangerous level.

The real cause of the 20 deaths, he suggested, might be heart failure produced by carbon monoxide asphyxiation. He stated that the medical data of the published health report did not include tests for carbon monoxide in the blood and hoped in future cases such tests for CO would be made. His recommendation for prevention of a future smog disaster was that waste gases be flared off as they leave the industrial stack. Thus, the toxic carbon monoxide would be converted into harmless carbon dioxide.

ENGINEERING GROUPS SPONSOR SMOKE ABATEMENT WEEK

"Smoke Has No Defense" was the theme on which a series of meetings was held in New York City during the week of October 24, 1949, designated as *National Smoke Abatement Week*. Sponsor of the sessions was the Mayor's Conference Committee, composed of representatives of the ASHVE, *ASME*, and *NAPE*.

Chairman of the Bituminous Coal Panel held on October 27 was O. O. Oaks, of ASHVE, Somerville, N. J. During the session, a number of recommendations for smoke abatement were made: the public should be educated in proper methods of firing bituminous coal; coal burning equipment should be properly installed and serviced; unskilled operators should be instructed in correct methods of firing and stoking; blends of coal could be used to advantage.

The Fuel Oils Panel on Friday included, in addition to a talk on the Donora disaster, a discussion on oil burner installations by John Schulz, Technical Editor, Fuel Oil and Oil Heat Magazine, New York, N. Y. Mr. Schulz emphasized the need for proper care and maintenance of oil burners. William G. Christy, smoke abatement engineer of Hudson County, N. J., stressed the human element and asked for cooperation from the public in order to police stacks as a supplement to the work of the smoke inspectors.

Among those who assisted in the smoke abatement conference were: A. A. Bearman, W. L. Fleisher, C. F. Kayan, and J. R. Weiss, all of New York Chapter, ASHVE. Professor Kayan was one of the speakers at the General Instruments Panel held on October 28 and Mr. Weiss was chairman of the Anthracite Coal Panel.

The conference was held in cooperation with the department of housing and buildings, Bureau of Smoke Control, New York City. J. J. Ryan, Jr., was general chairman.

FUEL CONSERVATION IN WARTIME DESCRIBED

How the Federal Government worked with private agencies to improve the utilization efficiency of fuel and stop waste during the war is described in Bulletin 469. "The National Fuel Efficiency Program During the War Years 1943-45." This book has recently been published by the Bureau of Mines, U. S. Dept. of the Interior, Washington, D. C., and is written by J. F. Barkley, K. M. Waddell and T. C. Cheasley, the latter being a member of the ASHVE.

This Bulletin describes how the work was accomplished, how the program was administered, and gives representative fuel savings which resulted in a number of individual plants. It can be obtained for 35 cents per copy from the U. S. Government Printing Office, Washington, D. C.

HEATING MINE BUILDINGS

The heating of mine buildings with space heaters is a problem because of the unusual heat loss, leakage and building shape encountered. An article describing a furnace-fan system for use in mine buildings was published in *Coal Age* magazine, July 1949 and has now been reprinted. Its authors are: Merle Guthrie, Hume, Mo. and R. P. Campbell, Kansas City, Mo., the latter being a member of the Society. This article gives information on the details, plant layout and results obtained from the installation of a heavy duty space heating system.

In Memoriam — John Howatt

October 22, 1880–October 22, 1949

John Howatt, who became a Life Member in 1945 and served as president of the Society in 1935, died on October 22, after an illness of several months. His passing will be mourned by his many friends in the Society and by his associates in the City of Chicago, where he served the past 36 years as chief engineer of the Board of Education and also as its business manager for the last five years.

The Officers and Council feel keenly the loss of a loyal and active member who was ever ready to serve, a splendid engineer, and a sincere friend.

Mr. Howatt was born in Banff, Scotland in 1880, and received his university education in the United States, graduating from the University of Minnesota in 1904. His career in engineering began with shop experience at the Westinghouse Electric and Manufacturing Co., East Pittsburgh, and later he joined the U.S. Navy Department in Seattle, Wash. Subsequently he became an engineering inspector of mechanical and electrical equipment for the U.S. Treasury Department. For a brief time he was a consulting and contracting engineer in Seattle.

From 1913 until his death he was chief engineer of the Board of Education and supervised the design, installation, and operation of mechanical and electrical equipment in Chicago public schools.

A member of the Society since 1915, Mr. Howatt had been very active in its affairs, both local and national. He served on many Society committees such as: the Committee on Schoolhouse Standards; Committee on Constitution and By-Laws; Committee on Engineering and Its Relation to Public Health; Committee on Relation of Body Changes to Air Changes; F. Paul Anderson Award Committee; ASHVE-*ASRE* Committee on National Standards for Air Conditioning Applications; Chairman of Exposition Advisory Committee; Guide Publication Committee; Chairman of TAC on Air Flow through Registers and Grilles; Committee on Chapter Relationship; Committee on Standards of Ventilation; Committee to Cooperate with Rochester School Board. He became a member of Council in 1927 and served on its Executive, Membership, Finance, and Meetings Committees, and on the Advisory Board. He also served as a member of the Committee on Research and was its chairman in 1934. Prior to being elected president of the Society in 1935, he served as First Vice President and Second Vice President. In 1920 he was President of Illinois Chapter and was an active worker until his death.

Mr. Howatt wrote extensively on engineering and philosophical subjects and was on the board of consulting and contributing editors of Heating, Piping & Air Conditioning for the past 20 years.

He was affectionately known to his associates as "Chief," was always ready and willing to be helpful to his fellowman and will long be remembered for his great interest in the advancement of his profession, the unselfish service he rendered to the Society and in civic affairs.

A fitting milestone in his service to the Society was the occasion of the 55th Annual Meeting in Chicago in January 1949 when he served as an honorary chairman of the Committee on Arrangements and as toastmaster at the banquet. His legion of friends in the Society and in other fields of activity will miss his genial presence and his keen sense of humor.

The Officers and Council extend their deepest sympathy to his widow, Della, his son, Gordon, his grandchildren, John and Patricia, to his brother, William, of Lake City, Minn., and to his sister, Mrs. Isabel Coulter of Mankato, Minn. Interment was at Lake City, Minn., on Wednesday, October 26.

OBITUARIES

Prof. B. F. Raber—The Society has been informed of the death of Benedict F. Raber, professor of mechanical engineering, and chairman, division of mechanical engineering, University of California, Berkeley.

Professor Raber was born in 1882 in Iowa and was educated in public schools in that state and Purdue University, Lafayette, Ind., receiving a B.S. degree in mechanical engineering. Upon his graduation, he joined the test department of the Santa Fe Railway, Topeka, Kan. He was in charge of fuel oil tests and the design of conversion furnaces for locomotives.

In 1908 he became an instructor at Purdue University, teaching classes in heating and ventilation, steam engine and turbine design, and power plants. Four years later, he became associate professor of mechanical engineering at the University of Nebraska, Lincoln. There he taught various mechanical engineering courses and also carried on consulting work with J. D. Hoffman and assisted in the writing of "Handbook for Heating and Ventilating Engineers." While at the University of Nebraska, he was also in charge of the design and installation of special laboratory equipment in mechanical engineering.

In 1915 he accepted an associate professorship in mechanical engineering at the University of California, Berkeley. He later became professor of mechanical engineering, giving undergraduate instruction in thermodynamics, refrigeration and air conditioning and power plant design. In addition, he taught graduate classes in air conditioning and power plant design.

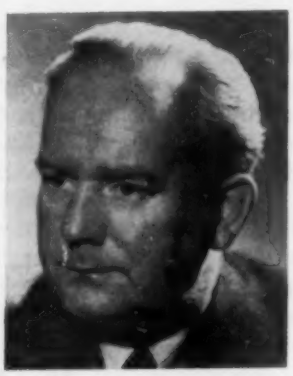
With Dr. B. M. Woods, Professor Raber wrote a bulletin, "Air Conditioning for Homes," the first edition of which numbered 18,000 copies. As consulting engineer, Professor Raber planned the air conditioning of several large buildings.

Prof. B. F. Raber
Berkeley, Calif.

Several papers of which he was co-author were presented at the Annual and Semi-Annual Meetings of the Society, and he was the co-author, with Prof. F. W. Hutchinson, of the books "Panel Heating and Cooling Analysis" and "Refrigeration and Air Conditioning Engineering." He was a member of the *ASME*.

Gosta E. Ekholm, an overseas member of the Society, died recently at his home in Stockholm, Sweden. Mr. Ekholm was born in 1897 in Stockholm and was educated at the Maskinfackskolan, Eskilstuna. In 1921 he entered the engineering field with Lundholm & Co. in Stockholm. In 1932 he became chief engineer for S. J. Carlsson & Co.

After association with Ullmans konstruktionsbyra and P. Naumburg & Co., he joined the HSB, the co-operative Tenants Union of Sweden, as chief engineer, and in 1942 he became the head of its heating and sanitary department. Mr. Ekholm had designed equipment for large buildings including hospitals, hotels and schools. He also designed installations for large housing projects. He was a member of the Swedish Ventilating and Sanitary Society.



G. E. Eckholm
Stockholm, Sweden

John J. Foley, Toronto, Ontario, Canada, died in October of a cerebral hemorrhage. He was born in Toronto in 1905 and received his education there. In 1924 he became associated with Universal Refrigeration, Ltd. At the time of his death he was president of the company. He had been a member of the Ontario Chapter of the Society for many years. Surviving are his widow, two daughters and son.

James M. Muckle, manager of the Hong Kong office of Andersen, Meyer & Co. Ltd., died of a heart attack, October 17, 1949, in Hong Kong, China, at the age of 56.

Mr. Muckle was born in Minnesota in 1893 and attended high school in San Jose, Calif. He served his apprenticeship in the heating and ventilating field until 1917, when he entered the U. S. Navy. After leaving the Navy in 1919, he was employed until 1929 as estimator, designer of layouts and supervisor of installations of heating and plumbing equipment. In 1929 he joined the Andersen, Meyer & Co. Ltd. in Shanghai, China, as chief of the plumbing and heating section. At the time of his death he was manager of the Hong Kong office. Mr. Muckle was in Shanghai at the time of the Japanese attack and was interned in Manila, P. I., for three and a half years. He is survived by his widow, Lydia.

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Combustion: R. K. Thulman, *Chairman;* P. R. Achenbach, J. F. Barkley, L. L. Connell, R. C. Cross*, R. B. Engdahl, J. C. Hauf, Jr., R. C. Johnson, W. B. Kirk, S. J. Levine, J. W. Miller, W. M. Myler, Jr., K. O. Schlentner, G. Schueder, E. T. Selig, Jr., T. H. Smoot, E. C. Webb.

Cooling Load: W. E. Zieber*, *Chairman;* R. D. Blum, W. F. Friend, R. H. Heilman, H. W. Heisterkamp, R. C. Jordan, C. F. Kayan, J. N. Livermore, R. H. Lock, C. O. Mackey, J. P. Stewart.

Corrosion: L. F. Collins, *Chairman;* A. S. Gates, Jr., A. E. Griffin, E. W. Guernsey, H. A. Pray, F. N. Speller, T. H. Urdahl*.

Heat Flow Through Glass: R. A. Miller, *Chairman;* A. B. Algren*, W. J. Arner, A. H. Baker, F. L. Bishop, Jr., R. D. Blum, G. W. Day, J. E. Frazier, J. S. Herbert, E. H. Hobbie, C. O. Mackey, F. W. Preston, W. C. Randall, C. A. Richardson, Vic Sanders, H. B. Vincent.

Heat Pump: R. C. Jordan, *Chairman;* E. R. Ambrose, R. D. Blum, C. F. Boester, C. W. Brown, W. F. Friend, C. F. Kayan, E. N. Kemler, J. D. Kroeker, E. P. Palmatier, S. S. Sanford, W. E. Zieber*.

Heating Load: T. F. Rockwell, *Chairman;* R. A. Biggs, A. I. Brown, R. C. Cross*, R. S. Dill, W. S. Harris, J. M. Hartman, L. G. Miller, S. I. Rottmayer, M. W. Shears, G. H. Tuttle.

Human Calorimetry: G. L. Tuve, *Chairman;* E. F. DuBois, M.D., J. D. Hardy, M.D., E. R. Queer*, L. E. Seeley, C. P. Yaglou.

Industrial Ventilation: W. N. Witheridge, *Chairman;* A. D. Brandt, J. H. Clarke, W. C. L. Hemeon, W. O. Huebner, C. W. Johnson*, J. M. Kane, M. G. Kershaw, L. L. Lewis, G. E. McElroy, H. A. Mosher, B. F. Postman, K. E. Robinson, B. R. Small, W. M. Wallace, II, R. P. Warren, H. E. Ziel.

Insulation: E. R. Queer*, *Chairman;* R. E. Backstrom, C. B. Bradley, R. B. Crepps, M. W. Keyes, H. E. Lewis, H. E. Robinson, Vic Sanders, T. D. Stafford, L. V. Teesdale, R. K. Thulman, T. T. Tucker, P. M. Woodworth.

Odors: T. H. Urdahl*, *Chairman;* N. E. Berry, W. V. Consolazio, C. L. Fay, W. A. Grant*, E. P. Heckel, G. W. Meek, H. T. Porter, Amos Turk, W. N. Witheridge.

Panel Heating and Cooling: P. B. Gordon, *Chairman;* A. B. Algren*, J. W. James*, J. S. Locke, S. K. Smith.

Group A—Heat Distribution Within and Behind the Panel: A. B. Algren*, *Chairman;* R. A. Biggs, R. S. Dill, H. L. Flodin, F. E. Giesecke, W. S. Harris, C. F. Kayan, G. D. Lain, R. L. Maher, C. W. Meininger, D. L. Mills, C. W. Nessell, P. S. Park, S. I. Rottmayer, E. E. Scott, S. K. Smith, R. K. Thulman, S. M. VanKirk, W. J. Widmer, G. L. Wiggs.

Group B—Heat Transfer Between the Panel and the Space: J. W. James*, *Chairman;* H. F. Randolph, *Vice Chairman;* C. M. Ashley, J. T. Bergen, C. F. Boester, Wharton Clay, Linn Helander, A. L. Jaros, H. A. Lockhart, W. E. Long, C. O. Mackey, R. A. Miller, G. W. Penney, G. G. Sward, J. M. van Nieukerken, H. E. Wheeler.

Group D—Controls: J. S. Locke, *Chairman;* H. W. Alyea, S. D. Browne, R. L. Campbell, C. M. Garner, P. B. Gordon, W. J. Hajek, A. J. Keating, W. H. Kliever, H. T. Kucera, P. F. Neess, J. K. M. Pryke, E. J. Ritchie, C. W. Signor, N. D. Skinner, A. S. Widdowfield.

Physiological Research: R. W. Keeton, M.D., *Chairman;* Thomas Bedford, A. R. Behnke, Capt., MC, USN, E. W. Brown, M.D., A. C. Burton, M.D., E. F. Dubois, M.D., A. P. Gagge, Lt. Col., MSC, USAF, F. K. Hick, M.D., J. W. James*, D. H. K. Lee, M.D., Charles Sheard, C. L. Taylor, C.-E. A. Winslow.

Sensations of Comfort: C. S. Leopold, *Chairman;* Lester T. Avery, John Everetts, Jr., Nathaniel Glickman, W. A. Grant, E. J. Rodee.

Sorbents: John Everetts, Jr., *Chairman;* G. C. F. Asker, I. W. Cotton*, F. C. Dehler, A. S. Gates, Jr., E. W. Gifford, E. R. McLaughlin, J. C. Patterson, G. L. Simpson, F. J. Swaney.

Sound Control: T. A. Walters, *Chairman;* C. M. Ashley, P. H. Geiger, Sidney Gordon, F. B. Holgate, G. C. Kerr, M. W. Keyes, R. D. Madison*, T. H. Troller, George Wohlberg.

*Member of Committee on Research

JOURNAL SECTION

OFFICERS OF LOCAL CHAPTERS AND STUDENT BRANCHES

(42 Chapters—9 Student Branches)

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• **BALTIMORE:** Organized 1949. Headquarters, Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. L. Crosby, 2315 St. Paul St., Baltimore 18. SECRETARY, W. P. Flanigan, 5508 Greenleaf Rd., Baltimore 10.

• **CENTRAL NEW YORK:** Organized 1944. Headquarters, Syracuse, N. Y. President, V. S. Day, 300 S. Geddes St., Syracuse 1. Secretary, J. H. Carpenter, 3515 Midland Ave., Syracuse 7.

• **CENTRAL OHIO:** Organized 1944. Headquarters, Columbus, Ohio. Meets, Third Monday. PRESIDENT, E. A. Norman, Jr., 1150 Chesapeake Ave., Columbus 12. SECRETARY, R. S. Curl, 80 S. Third St., Columbus 15.

• **CINCINNATI:** Organized 1932. Headquarters, Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, K. B. Little, 832 Temple Bar Bldg., Cincinnati 2. SECRETARY, D. J. Wood, 659 E. Sixth St., Cincinnati.

• **CONNECTICUT:** Organized 1940. Headquarters, New Haven, Conn. Meets, Third Thursday. PRESIDENT, Winfield Roeder, 405 Temple St., New Haven. SECRETARY, T. L. Arnold, 26 Francis Ave., Hartford.

• **DELTA:** Organized 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. PRESIDENT, R. B. Guest, 827-37 Dryades St., New Orleans 13. SECRETARY, Theodore Offner, 1000 S. Peters St., New Orleans.

• **GOLDEN GATE:** Organized 1937. Headquarters, San Francisco, Calif. Meets, First Thursday. President, H. V. Hickman, 1129 Folsom St., San Francisco 1. Secretary, R. C. Cushing, 1136 Howard St., San Francisco 3.

• **ILLINOIS:** Organized 1906. Headquarters, Chicago, Ill. Meets, Second Monday. PRESIDENT, J. S. Kearney, 1905 Greenleaf St., Evanston. SECRETARY, G. W. Bornquist, 629 W. Washington Blvd., Chicago 6.

• **INDIANA:** Organized 1943. Headquarters, Indianapolis, Ind. Meets, Fourth Friday. PRESIDENT, W. R. Fenstermaker, 937 Architects & Builders Bldg., Indianapolis 4. SECRETARY, F. C. Barton, 938 K of P Bldg., Indianapolis.

• **IOWA:** Organized 1940. Headquarters, Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, D. E. Wells, 304 Home Federal Bldg., Des Moines 9. SECRETARY, C. P. North, P.O. Box 833, Des Moines 4.

• **KANSAS CITY:** Organized 1917. Headquarters, Kansas City, Mo. Meets, First Monday. PRESIDENT, Henry Nottberg, Jr., 914 Campbell, Kansas City 6. SECRETARY, C. W. Schumacher, 1922 Grand Ave., Kansas City 9.

• **MANITOBA:** Organized 1935. Headquarters, Winnipeg, Man., Canada. Meets, Third Thursday. President, A. W. Moss, 268 Yale Ave., Winnipeg. Secretary, C. M. Fleming, 447 Main St., Winnipeg.

• **MASSACHUSETTS:** Organized 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. PRESIDENT, W. H. Shipp, 124 Lewis Rd., Belmont 78. SECRETARY, J. P. Licandro, 177 State St., Boston.

• **MEMPHIS:** Organized 1944. Headquarters, Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Wellford, Jr., 730 S. Third St., Memphis 2. SECRETARY, A. T. Bevil, 1521 Waverly Ave., Memphis 6.

• **MICHIGAN:** Organized 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, L. A. Burch, 5853 Hamilton Ave., Detroit 2. SECRETARY, J. H. Spurgeon, 5050 Joy Rd., Detroit 4.

• **MINNESOTA:** Organized 1918. Headquarters, Minneapolis, Minn. Meets, First Monday. PRESIDENT, R. C. Jordan, University of Minnesota, Minneapolis 14. SECRETARY, E. F. Snyder, Jr., 4324 Zenith Ave., N., Minneapolis 12.

• **MONTREAL:** Organized 1936. Headquarters, Montreal, Que., Canada. Meets, Third Monday. President, S. W. Salter, 3410 Trenholme Ave., Montreal. Secretary, J. G. Chenevert, 1010 St. Catherine St., W., Montreal.

• **NEBRASKA:** Organized 1940. Headquarters, Omaha, Neb. Meets, Second Tuesday. PRESIDENT, C. A. Carter, 3019 Grebe St., Omaha 12. SECRETARY, K. E. Martin, 803 Patterson Bldg., Omaha 2.

• **NEW YORK:** Organized 1911. Headquarters, New York, N. Y. Meets, Third Monday. President, H. S. Johnson, 39 Cortlandt St., New York 7. Secretary, Carl H. Flink, Room 3000, 51 Madison Ave., New York 10.

• **NORTH CAROLINA:** Organized 1939. Headquarters, Durham, N. C. Meets, Quarterly. President, DeParx Stimson, 121 Idlewilde Dr., Winston-Salem. Secretary, R. B. Crosland, Jr., 1001 S. Marshall St., Winston-Salem.

• **NORTH TEXAS:** Organized 1938. Headquarters, Dallas, Tex. Meets, Third Monday. PRESIDENT, G. A. Linskie, Buckner Blvd., Dallas 10. ACTING SECRETARY, R. G. Lyford, 2415 N. Pearl St., Dallas.

• **NORTHEASTERN OKLAHOMA:** Organized 1948. Headquarters, Tulsa, Okla. President, W. R. Lee, 303 Beacon Bldg., Tulsa 3. Secretary, R. F. Shoemaker, 1136 So. Peoria, Tulsa.

• **NORTHERN OHIO:** Organized 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. L. Byers, 1740 E. 12th St., Cleveland 14. SECRETARY, G. V. Parmelee, 94 Solon Rd., Chagrin Falls.

• **OKLAHOMA:** Organized 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. President, H. S. Shafer, 400 Key Bldg., Oklahoma City 2. Secretary, R. E. Swan, 117 N.W. First St., Oklahoma City.

• **ONTARIO:** Organized 1922. Headquarters, Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, A. J. Strain, 474 Bathurst St., Toronto. SECRETARY, H. R. Roth, 57 Bloor St., W., Toronto, Ont.

• **OREGON:** Organized 1939. Headquarters, Portland, Ore. Meets, Thursday after First Tuesday. President, J. P. McDermott, 308 Dekum Bldg., Portland 4. Secretary, K. H. Hanson, 6317 S.E. 40th St., Portland.

• **PACIFIC NORTHWEST:** Organized 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday. PRESIDENT, J. D. Sparks, 7331 W. Green Lake Way, Seattle 3. SECRETARY, W. B. Pride, 3228 37th Pl., Seattle 44.

• **PHILADELPHIA:** Organized 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. President, F. H. Buzzard, 213-15 S. Broad St., Philadelphia 7. Secretary, C. F. Dietz, 3449 W. Indiana Ave., Philadelphia 32.

• **PITTSBURGH:** Organized 1919. Headquarters, Pittsburgh, Pa. Meets, Second Monday. PRESIDENT, H. J. Kirkendall, 291 Catalpa Pl., Pittsburgh 16. SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St., Pittsburgh 22.

• **ROCKY MOUNTAIN:** Organized 1944. Headquarters, Denver, Colo. Meets, First Wednesday. PRESIDENT, E. J. McEahern, 1146 Market, Denver 4. SECRETARY, N. H. Brickham, 2715 S. Humboldt, Denver.

• **ST. LOUIS:** Organized 1918. Headquarters, St. Louis, Mo. Meets, First Tuesday. PRESIDENT, W. A. Russell, 7918 Kingsbury Blvd., Clayton 5. SECRETARY, H. C. Sharp, 4060 W. Pine Blvd., St. Louis 8.

• **SHREVEPORT:** Organized 1948. Headquarters, Shreveport, La. Meets, Third Thursday. President, A. H. Otto, 1020 Market St., Shreveport. Secretary, S. W. Beaty, P.O. Box 1734, Shreveport.

• **SOUTH TEXAS:** Organized 1938. Headquarters, Houston, Tex. Meets, Third Friday. PRESIDENT, R. J. Salinger, 4510 Dewberry Lane, Houston 4. SECRETARY, G. J. Collins, P.O. Box 2463, Houston.

• **SOUTHERN CALIFORNIA:** Organized 1930. Headquarters, Los Angeles, Calif. Meets, Third Wednesday. PRESIDENT, J. L. Blake, 1700 S. Bedford St., Los Angeles 35. SECRETARY, M. C. Greiner, 1559 Club View Dr., Los Angeles 24.

• **SOUTHWEST TEXAS:** Organized 1946. Headquarters, San Antonio, Tex. Meets, Second Tuesday. President, G. R. Rhine, 1208 Alamo National Bldg., San Antonio. Secretary, I. W. Wilke, P.O. Box 1154, Austin 3.

• **UTAH:** Organized 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. President, C. E. Ferguson, 838 E. Garfield Ave., Salt Lake City. Secretary, A. R. Curtis, 2211 Highland Dr., Salt Lake City.

• **VIRGINIA:** Organized 1946. Headquarters, Norfolk, Va. President, J. E. White, 7607 Gloucester Ave., Norfolk 5. Secretary, D. E. Phillips, P.O. Box 674, Newport News.

• **WASHINGTON, D. C.:** Organized 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. President, P. R. Achenbach, Connecticut & Van Ness St., Washington, D. C. Secretary, J. G. Muirheid, 2013 New Hampshire Ave., N. W., Washington 9.

• **WESTERN MICHIGAN:** Organized 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, J. A. Alexander, P. O. Box 132, Station C, Grand Rapids. SECRETARY, L. A. Calcaterra, 1136-42 Plainfield Ave. N.E., Grand Rapids.

• **WESTERN NEW YORK:** Organized 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. PRESIDENT, F. J. Weber, 443 Delaware Ave., Buffalo 2. SECRETARY, J. M. Quackenbush, 610 Linwood Ave., Buffalo.

• **WISCONSIN:** Organized 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. PRESIDENT, B. M. Kluge, 1817 So. 66th St., Milwaukee 14. SECRETARY, J. A. Lofte, 2505 N. 97th St., Wauwatosa, 13.

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• **COLLEGE OF CITY OF NEW YORK:** Organized 1949. Headquarters, New York, N. Y. PRESIDENT, Norman Moskowitz, 153 Clinton Ave., Brooklyn 5. SECRETARY, Seymour Oestreicher, 2009 Bryant Ave., New York 60.

• **LOUISIANA POLYTECHNIC INSTITUTE:** Organized 1949. Headquarters, Ruston, La. PRESIDENT, J. C. Cox, 417 W. Mississippi, Ruston. SECRETARY, H. D. Hayes, Box 409 Tech Station, Ruston.

• **NORTH CAROLINA STATE COLLEGE:** Organized 1948. Headquarters, Raleigh, N. C. PRESIDENT, J. J. Andrews, 710 Harvey St., Raleigh. SECRETARY, E. A. Stroupe, Jr., 416 Halifax St., Raleigh.

• **OREGON STATE COLLEGE:** Organized 1949. Headquarters, Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, M. B. Larson, 2311 N. E. Hancock, Portland 12. SECRETARY, Helen P. Lankow, 1349 S. E. Birch St., Portland 14.

• **PURDUE UNIVERSITY:** Organized 1948. Headquarters, W. Lafayette, Ind. CHAIRMAN, C. M. Sallman, and SECRETARY, D. M. Williams, c/o W. T. Miller, Mechanical Engineering Bldg., Purdue University, W. Lafayette.

• **TEXAS A. & M. COLLEGE:** Organized 1946. Headquarters, College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, R. N. Hughes, Box 914, College Station, Tex. SECRETARY, W. J. Bowen, Box 1913, College Station, Tex.

• **UNIVERSITY OF DETROIT:** Organized 1949. Headquarters, Detroit, Mich. Meets First Tuesday. PRESIDENT, L. M. Blanchette, 2345 Holcomb, Detroit 14. SECRETARY, S. H. Kosinski, 4439-30th, Detroit 10.

• **UNIVERSITY OF KANSAS:** Organized 1949. Headquarters, Lawrence, Kans. President, V. N. Elder, 643 Tennessee, Lawrence. Secretary, L. H. Noll, 1235 New York St., Lawrence.

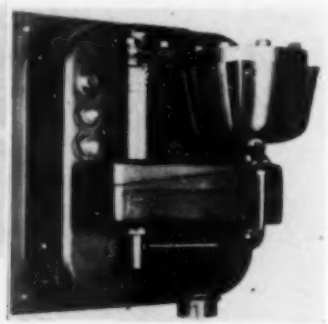
• **UNIVERSITY OF TEXAS:** Organized 1949. Headquarters, Austin, Tex. PRESIDENT, D. S. Belvin, 2837½ San Gabriel, Austin. SECRETARY, G. G. Marwill, 708 West 24½ St., Austin.

EQUIPMENT DEVELOPMENTS

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1949 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

HPAC 4216—DUAL BULB THERMOSTAT FOR HOT WATER HEATING—A new dual bulb thermostat designed to minimize thermal lag in hot water heating systems is offered by Barber-Colman Co., Rockford, Ill.

The hot water supply temperature is controlled in proportion to the outside temperature. System overshooting, says the company, is offset by an outdoor bulb which adjusts the thermostat control point to anticipate changes in heating requirements. The thermostat, with indoor bulb located in the supply line, controls a boiler bypass valve, oil burner, or stoker to maintain supply water temperature. Adjustable for minimum water temperature, units are available for different outside to supply water temperature ratios and for proportioning or two position control.



Above: Thermostat
Right: Flow Meter

HPAC 4217—FLOW METER—Hays Corp., Michigan City, Ind., is marketing a new "Magna-Clutch" flowmeter which utilizes a magnetic clutch to transmit the movement of the float.

Manufactured in the plant of Penn Industrial Instrument Corp. but sold through the Hays organization, the meter is said to provide exceptional power with little friction because of the large float (3.75 in. in diameter) and long float travel (1.5 in.). No stuffing box is used. The movement of the float is transmitted through a pressure tight manometer by means of the magnetic clutch.

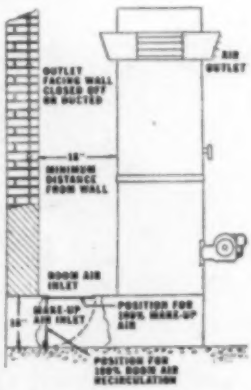
Five adjustable range tubes adapt the device to water differentials from 17 in. to 750 in. Working pressures are 1500 psi and 2500 psi, convertible in the field. Six types or combinations of recording, indicating, and integrating meters are offered.

HPAC 4218—PIPE INSULATION—A new "Fiberglas" molded pipe insulation, designed to withstand temperatures up to 800 F, is offered by Owens-Corning Fiberglas Corp., 1911 Nicholas Bldg., Toledo 1. Known as PF pipe insulation, type 80, the new product is made of glass fibers bonded by a thermosetting binder and is molded in cylindrical form in all standard sizes up to 30 in.

The 800 deg temperature limit of the new pipe insulation is said to represent a 200 deg advance over the maximum limit of the company's type 60 molded pipe insulation heretofore available.

The new insulation is available with a 4 oz canvas cover as a standard stock item but can be supplied with a heavier canvas cover, or with a 35 lb roofing felt jacket in place of canvas, for use in locations where it will be subject to occasional wetting.

HPAC 4219—HEATER FOR MAKE-UP AIR—A new model "Thermobloc" self contained direct fired industrial heating unit is recommended for tempering make-up air in buildings where ventilating systems impose heavy heating loads in cold weather. The manufacturer is Prat-Daniel Corp., East Port Chester, Conn.


AIR OUTLET
OUTLET FACING WALL CLOSED OFF OR DUCTED
MINIMUM DISTANCE FROM WALL
ROOM AIR INLET
MAKE-UP AIR INLET
POSITION FOR 100% ROOM AIR RECIRCULATION

The unit is positioned along the building wall, with an air intake duct running through the wall to the heater. According to the company, units may be used either as a plant heating system or for auxiliary heating.

HPAC 4220—D-C MOTORS FOR MANY USES—The new type SK, d-c "Life-Line" motors, in sizes from 1 to 30 hp, are available from Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30.

Heavy steel end brackets are used to provide strength, rigidity, and correct bearing alignment. Prelubricated and sealed ball bearings do not require greasing. Units are offered in frames 203 to 365 and are available for constant, adjustable, or varying speed applications and for either constant or intermittent service. Motors can be supplied with shunt, compound, or series winding for 115, 230, 550, or 660 volts.

[*Continued on page 144*]

FOR YOUR CONVENIENCE

Heating, Piping & Air Conditioning [12-49]
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

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4236	4237	4238	7496	7497	7498	7499	7500	7501	7502
7503	7504	7505	7506	7507	7508	7509	7510	7511	7512
7513	7514	7515	7516	7517	7518	7519	7520	7521	7522
7523	7524	7525							

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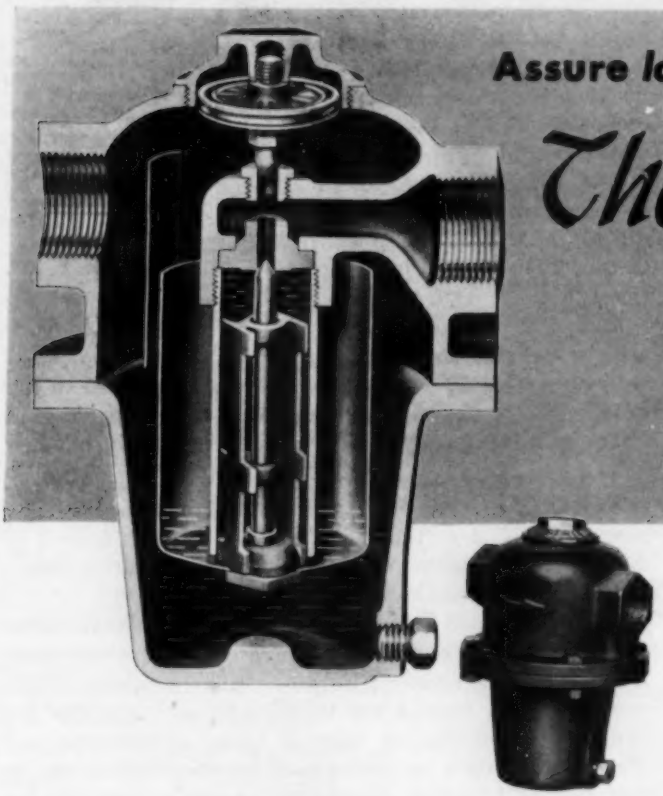
ILLINOIS
Float & Thermostatic TRAPS



Assure *lower* return line temperatures

They're different!

–in construction

–in performance

ILLINOIS Float & Thermostatic Traps operate under vacuum with the same high efficiency as under pressure. No more water-logging of mains . . . no more air binding . . . end "morning overload" troubles. The instantaneous action of the condensate valve assures complete drainage of condensate. A separate thermostatically controlled valve vents air continuously in large volume, yet positively prevents loss of steam.

Recommended Applications

Low Pressure Heating Systems, Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Large Radiators or Pipe Coils, Hot Water Generators, Drips of Mains and Risers. Draining Coffee Urns, Warming Tables, Pasteurizers, Vacuum Pans, Heat Exchangers, Process Heaters, Sterilizers, Autoclaves, Cooking Kettles, Kilns and similar equipment.

(For operating ranges from 25 inches vacuum to 15 pounds pressure use Series G Traps. For pressures up to 50 pounds use Series MG.)

Rated capacities of various size traps from 200 pounds to 5000 pounds condensate per hour, at 2 pounds differential across the trap.

Positive, Instantaneous Valve Action . . . an Exclusive Feature

The Snap Action of the Condensate Control Valve assures efficient trap operation. The valve is not directly attached to float but is actuated by impact of the dropping float. Valve action is instantaneous whether the trap is handling its maximum capacity or only a trickle of condensate and regardless of variation in pressures. The valve is either wide open or tight shut—never cracked on seat, never hanging in an intermediate position. It is water-sealed at all times. It cannot chatter and is never affected by pulsations in the flow of condensate to the trap.

Simple, Compact, Trouble-proof

No ball floats to puncture or collapse—no toggles, pins, levers or hinges to corrode, stick or bend. Hard, stainless alloy steel renewable valves and seats are used for both condensate and air bypass units. Both valve units are at the top of trap out of dirt and sludge, assuring long life and satisfactory operation without attention. Straight through connections save head room, fittings, trenching, labor, and avoid low hung piping or lifts. Trap is easily opened for inspection without disturbing piping.

TRAP NOT DAMAGED BY FREEZING. Freezing will not harm this trap in any way and it is self-thawing.

Write for Bulletin 34-C

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

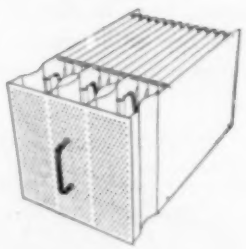
Only Electromaze gives you these big improvements in electric air filtering!

Any electrostatic precipitator will give you super clean air—remove even smoke and other invisible, sub-micronic particles. But the new Electromaze goes further—gives you dozens of exclusive features that increase operating efficiency and simplify lay-out, installation and maintenance. For details, see below. For the complete story, see your nearby Air-Maze representative. Air-Maze Corporation, 5200 Harvard Avenue, Cleveland 5, Ohio.

P. S. When planning improvements in air filtration be sure to call in your consulting engineer. His lifetime experience is yours for the asking. And you can act on his recommendations with confidence.

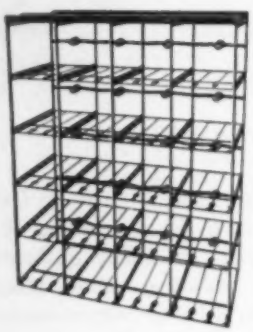
IONIZER AND COLLECTOR IN SINGLE CELL

Use of a single high voltage in both ionizer and collector permits unitized construction. Each cell is a complete filter in itself. All aluminum plate construction resists corrosion. Light and easy to handle. A standard cell 12″ high by 12″ wide weighs only 20¼ lbs.!



"DESK DRAWER" DESIGN

Cells (as well as rectifier) slide in and out of frames like desk drawers—automatically make or break electrical connection. Can instantly be removed for inspection, servicing or replacement. All high voltage wiring is *inside* duct because power pack is part of filter assembly. Easier to install.



"BUILDING BLOCK" INSTALLATION

Treated steel frames bolt together in a jiffy to form banks built like a skyscraper. Your choice of any combination of cells 4″ x 12″, 8″ x 12″ or 12″ x 12″ permits installation in restricted spaces.

DUAL IONIZATION

Two ionizing wires instead of one insure maximum charging of dirt particles. Double protection in case of wire breakage. Smaller diameter wire practically eliminates dirt build-up, insuring maximum efficiency at all times.

EASIER SERVICING

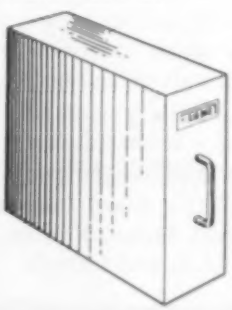
"Desk drawer" cells may be cleaned while in place with ordinary city water pressure

or

where no drain or water connection is available, cells may be quickly removed, cleaned and oiled in separate tank.

SELF-ADJUSTING POWER SUPPLY

Exclusive phase-shifting "Monocyclic" network controls rectified output voltage by controlling input current. Automatically compensates for normal line fluctuations, minimizes normal spark-over occurrence. Maintains optimum filtering efficiency during entire dirt-collecting period. Provides full protection against even a complete short circuit.

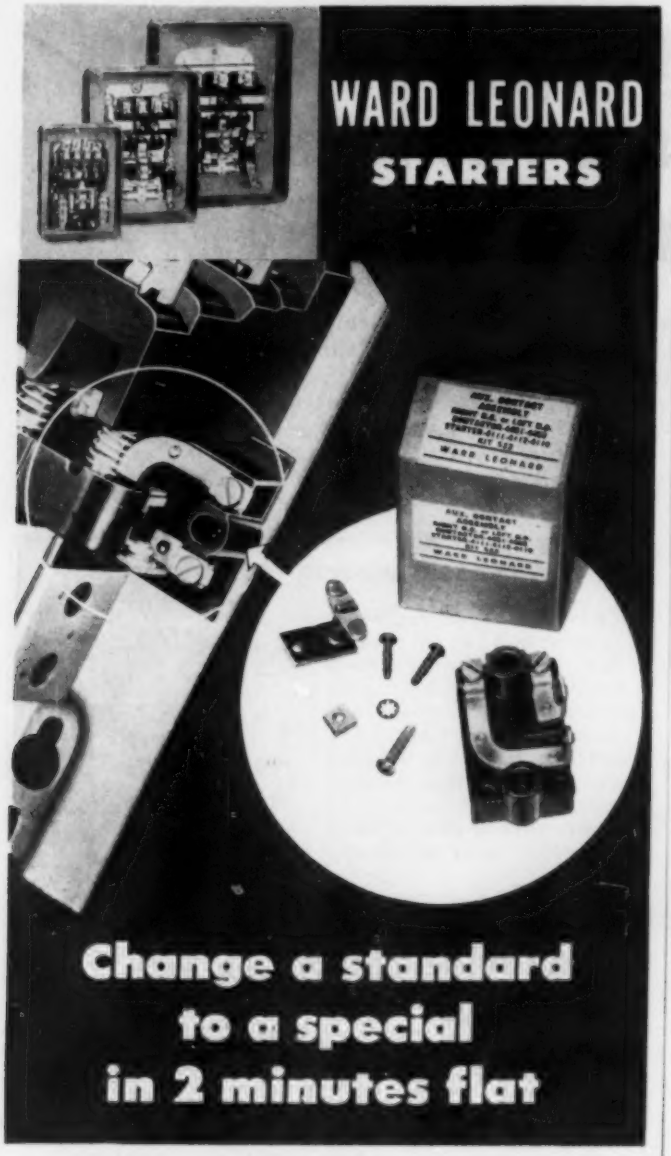


AIR FILTERS
SILENCERS
SPARK ARRESTERS

AIR-MAZE

THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS



Because basic design permits easy conversion

To reduce the number of control components carried in Original Equipment Manufacturer's stock, Ward Leonard offers auxiliary contact kits.

All parts including necessary hardware are packaged for quick identification, convenience in stocking and fast unit assembly. No special tools needed.

Auxiliary contacts can be assembled on all size 1, 2 and 3 solenoid starters. Available as normally open or normally closed contacts for right or left hand mounting.

Write Ward Leonard Electric Company, 24 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

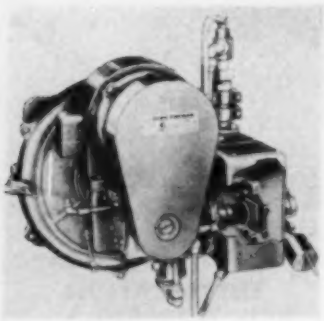
WARD LEONARD ELECTRIC COMPANY
Result-Engineered Controls
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

(Continued from page 139)

HPAC 4221—OIL BURNER PUMP—Iron Fireman Mfg. Co., 3170 W. 106th St., Cleveland 11, has developed a positive displacement, variable volume pump, which is submerged in the oil reservoir of its industrial oil burners to meter fuel to the rotary atomizing cup. By this means, says the company, its industrial oil burners can burn any weight of oil from No. 1 to No. 6 or the Canadian Bunker Q oil without manual adjustment.

Called the oil "Volumeter," the pump requires no feed valve, adjustable port, or viscosity compensating device, because the amount of oil fed to the burner is determined by the movement of pistons in multiple cylinders. The rate of oil feed is governed by the length of the piston stroke, which in turn is controlled by a cam mechanism. Neither oil temperature nor viscosity affects the rate of feed, it is claimed.

The unit, which is now an integral part of the firm's industrial oil burners, has a control lever either automatically or manually operated. A gear type pump with return flow to the oil tank is used to maintain a full reservoir with reserve oil capacity. Air from the suction line is automatically vented from the top of the reservoir.



Oil Burner Has New Pump

Pipeline Strainer

HPAC 4222—PIPE LINE STRAINER—Strong, Carlisle & Hammond Co., 1392 W. Third St., Cleveland 13, has added a new strainer to its line. Primarily designed for the protection of steam traps, reducing valves, temperature controls, etc., this new strainer is recommended for removing impurities such as lint, scale, dirt, or sand from steam, air water, or gas.

Sizes range from ¼ to 2 in. for steam pressures to 250 psi, or cold pressures to 400 psi. Special features are said to include a monel screen easily removed for cleaning, an "extra heavy" semi-steel body with self centering screen guides to prevent crushing, new gripping lugs on inlet and outlet bosses designed to permit installation with any type of wrench.

Cast steel strainers are available for steam pressures to 600 psi, in sizes from ¼ to 4 in.

HPAC 4223—EXPANSION JOINT GUIDE, ANCHOR—A new, simplified and standardized method for guiding and anchoring expansion joints on long rigid members is said to be incorporated in the anchor guide developed by Piping Specialties, Inc., 114 Liberty St., New York 6. This rigid member is designed to insure alignment of working parts at and around the expansion joint and to eliminate the necessity for figuring anchor thrusts and the attachments between pipe and structure.

"CHICAGO" TYPE "D"

HEAVY DUTY

Building and Industrial Pump

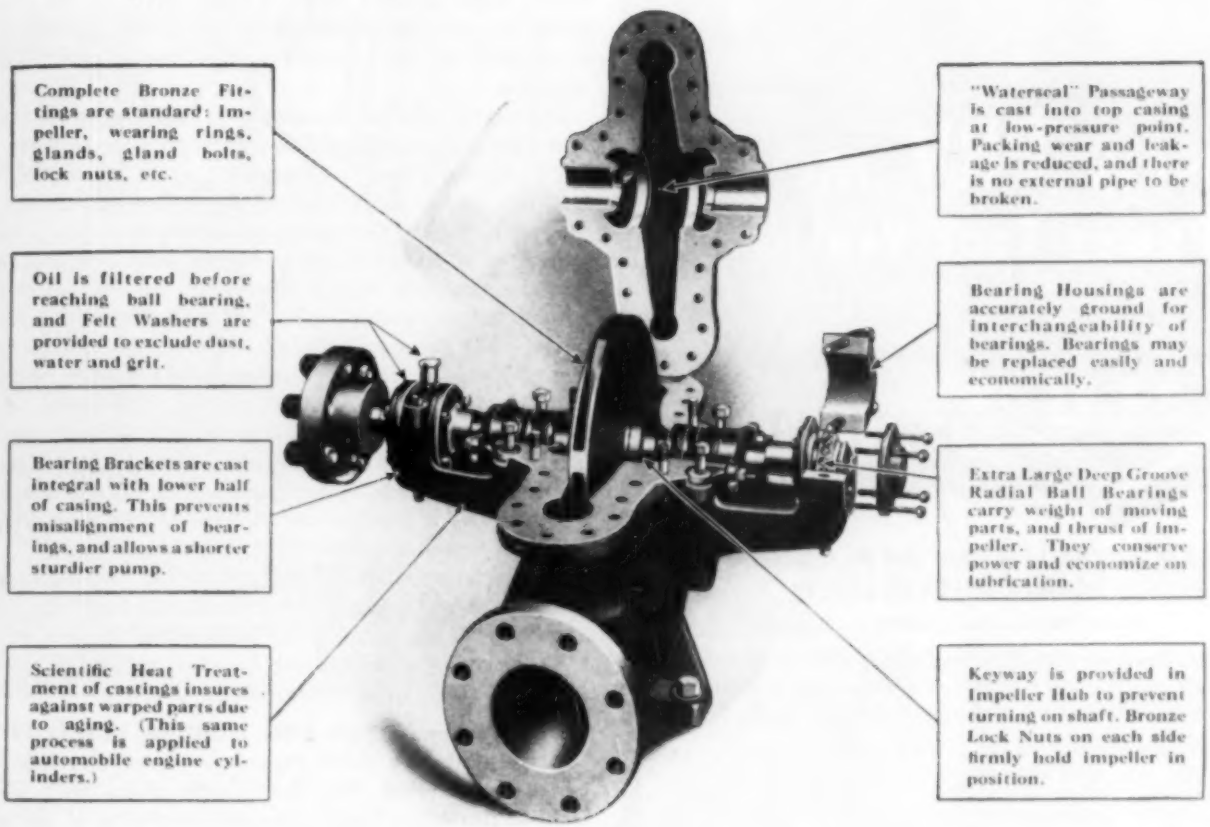

Complete Bronze Fittings are standard: Impeller, wearing rings, glands, gland bolts, lock nuts, etc.
Oil is filtered before reaching ball bearing, and Felt Washers are provided to exclude dust, water and grit.
Bearing Brackets are cast integral with lower half of casing. This prevents misalignment of bearings, and allows a shorter sturdier pump.
Scientific Heat Treatment of castings insures against warped parts due to aging. (This same process is applied to automobile engine cylinders.)
"Waterseal" Passageway is cast into top casing at low-pressure point. Packing wear and leakage is reduced, and there is no external pipe to be broken.
Bearing Housings are accurately ground for interchangeability of bearings. Bearings may be replaced easily and economically.
Extra Large Deep Groove Radial Ball Bearings carry weight of moving parts, and thrust of impeller. They conserve power and economize on lubrication.
Keyway is provided in Impeller Hub to prevent turning on shaft. Bronze Lock Nuts on each side firmly hold impeller in position.

Figure E820 — Type "D" Single Stage Pump

Capacities from 25 to 1900 GPM — Heads up to 530 feet

Best Materials Available and Skilled Craftsmanship in Every Chicago Pump

CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems

Flush-Kleen Sewage Ejectors
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.

NEW "PRV" MODEL
Power Roof Ventilator
(DIRECT-DRIVE CENTRIFUGAL FAN TYPE)

ILG VENTILATION

NEW EFFICIENCY! NEW ECONOMY!
NEW CONVENIENCE!

EASILY INSTALLED . . . WIRED . . . SERVICED

ILG-designed, ILG-built for exhaust duty from vertical flues in multi-story buildings or from duct systems. 10 sizes to operate against resistances from ¼" to 1½".

- **LOAD-LIMITING WHEEL**—BC type with non-overloading feature, mounted directly onto motor shaft.
- **BALL-BEARING MOTOR**—Vertical type. Proven ILG design. Not affected by dirt, grease, lint.
- **WEATHER-PROOF HOUSING**—Galvanized steel or copper. Low, handsome silhouette.
- **LEAK-PROOF CONSTRUCTION** — Exclusive leak-proof flange on base.
- **FLEXIBLE** — Standard unit provided with access door and shutter track for conversion to any type air control at or after installation.
- **EASY INSTALLATION, SERVICING**—Just six major assemblies. Electrical box and safety switch ease wiring. Hinged top and access door in base simplify servicing.
- **ILG "ONE-NAME-PLATE" RESPONSIBILITY** — Covers entire unit including motor.

SEND TODAY FOR FREE BULLETIN

ILG ELECTRIC VENTILATING COMPANY
2841 North Crawford Avenue, Chicago 41, Illinois

☐ Please send me FREE data on the new "PRV" Power Roof Ventilator

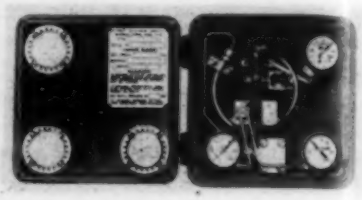
Firm Name.....

Executive's Name.....Title.....

Address.....Zone.....

City.....State.....

The device takes up increased length of pipe due to expansion, is readily fastened to the building, and is welded to the pipe in the field. According to the company, it can be modified to accommodate angular changes in a run of pipe.

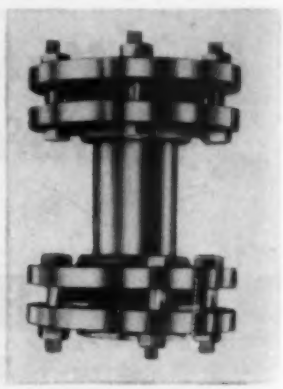


HPAC 4224—PNEUMATICALLY OPERATED CONTROLLERS—According to Fisher Governor Co., Marshalltown, Iowa, its "Wizard" pneumatically operated controllers are used on applications where large demand changes may occur in the system under control and where accurate control (within 1 to 5 percent) of the static pressure to be controlled is required.

Operation is based on simple pressure pilot actuation. The operating medium flows through two orifices, one fixed and the other variable, with a tee connection and lead line to the diaphragm of the main control between the two orifices. The operating medium pressure is maintained at a constant value by an auxiliary regulator, and the pressure on the diaphragm may be varied by adjusting the variable orifice which bleeds to the atmosphere. With proper orifices and with 20 psi operating medium supply pressure, intermediate pressure ranges of 3 to 15 psi may be applied on the diaphragm of the main control valve. Air or gas is the operating medium used and the pressure measuring element to which the controlled pressure is connected is a Bourdon tube (or a bellows for low pressure applications). The tube actuates a flapper which regulates the variable orifice.

The remote control unit, type 4100U, shown here, is available as a reverse or direct acting pilot and the action can be reversed in the field. It is available with bronze, steel, or high pressure steel Bourdon tubes.

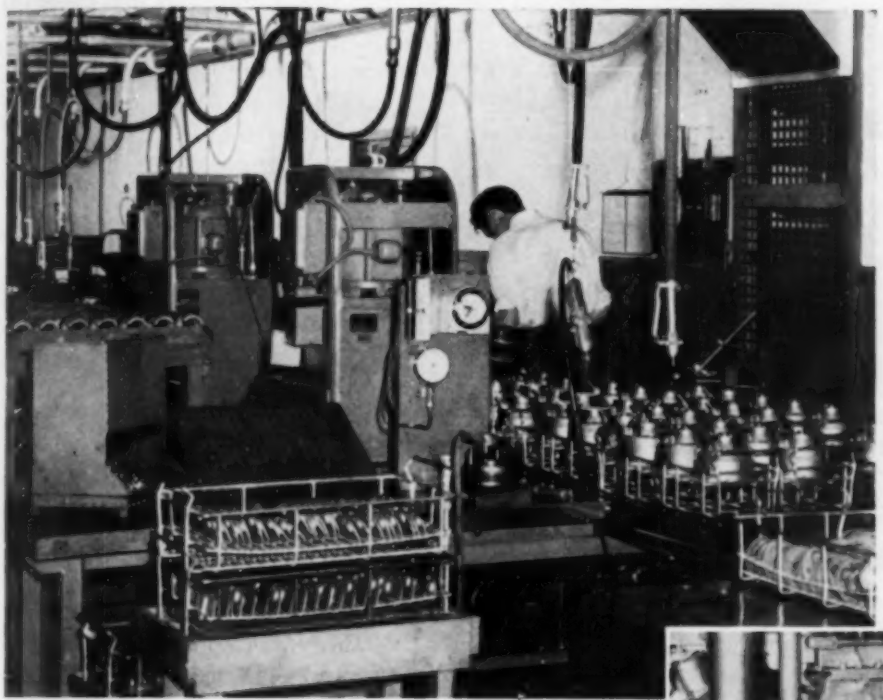
HPAC 4225—JOINTS FOR RUBBER LINED PIPE—"Gaco" joints for lined pipe have been developed by Gates Engineering Co., New Castle Ave., New Castle, Del., to provide a rapid, inexpensive means of installing and repairing all types of rubber lined pipe. This, according to the company, makes possible the purchase of rubber lined pipe by length, cutting and installing on the job being done by plant personnel.



To make the joint, portable equipment or a standard pipe machine equipped with an adapter is used to cut, groove, and counterbore the lined pipe sections. Flanges

"Ideal Atmosphere"

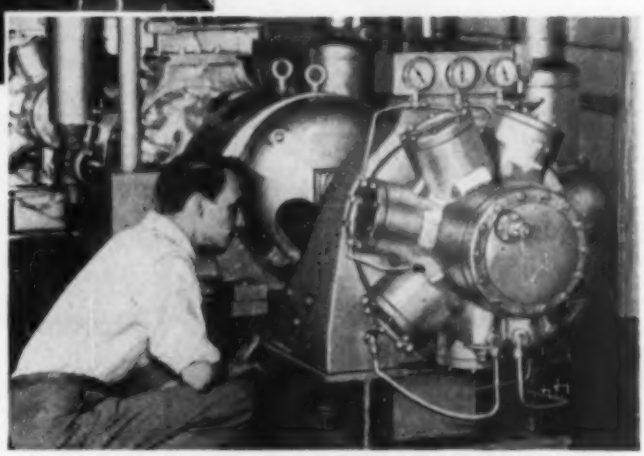
FOR EFFICIENT MANUFACTURING



... BORG-WARNER provides it with

CHRYSLER AIRTEMP
DIVISION OF CHRYSLER CORPORATION

AIR CONDITIONING



● When air must be filtered clean of dust and dirt—when temperature and humidity must be maintained at uniform levels—when worker comfort and efficiency is an important factor—air conditioning gets the call . . . and with many of America's leading companies, that means Chrysler Airtemp.

Chrysler Airtemp units—like the big 75 h.p. radial units that air condition Borg-Warner's manufacturing, assembly departments and offices—have built a world-wide reputation for low-cost, dependable, trouble-free performance. Year in, year out, their performance testifies to the excellence of Chrysler Corporation engineering.

When you think of air conditioning for *your* needs, remember the experience of thousands of satisfied users and install Chrysler Airtemp. We'll be glad to send full descriptive literature—write today.

(Top Photo)—Scene in Borg-Warner division's manufacturing unit at Chattanooga, Tenn.

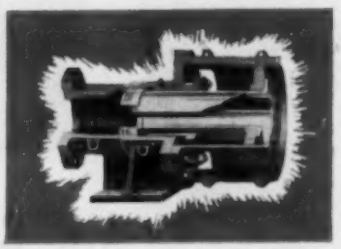
(Lower Photo)—Partial view of the battery of 3 75-h.p. Chrysler Airtemp "Radial-Sealed" compressor units which create ideal indoor climate for B-W workers.

Chrysler Airtemp AIR CONDITIONING

AIRTEMP DIVISION OF CHRYSLER CORP., DAYTON 1, OHIO • In Canada: Therm-O-Rite Products, Ltd., Toronto

PACK THIS **ADSCO EXPANSION JOINT**
UNDER FULL OPERATING PRESSURE

No "Down" Time; No Costly Interruptions To Service



The ADSCO Piston-Ring Type Expansion Joint can be completely repacked *without* shutting off pressure or disturbing service. Eliminate expensive shut downs; cut operational time losses. Specify ADSCO for continuous, trouble-free operation.

Only ADSCO builds the Piston-Ring Type Expansion Joint. Only ADSCO gives you all these features:

1. Sliding surface of slip in contact with packing only—no metal-to-metal contact—no scoring of the slip.
2. Slip is completely guided, internally and externally.
3. Split external guide needs no extra space for removal.
4. Limit stops prevent over-travel—slip cannot be pulled out of body.
5. Packing is easily lubricated and its life prolonged indefinitely.
6. Available in a full range of sizes—for pressures to 400 psi and greater—and for temperatures to 750 F. and higher.

For complete information write for Bulletin H-35-15F.

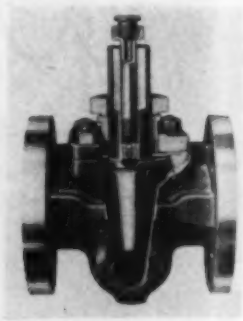
ADSCO
EXPANSION JOINTS — HEAT EXCHANGERS
STEAM TRAPS — STRAINERS — METERS
CASING — ANCHORS — GUIDES
Leaders Since 1877
AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N. Y.

are slipped on the joints or assembly fittings and locking or flange retainer rings are inserted in the grooves. A rubber insert or flange is slipped into place and the flanges are bolted together.

HPAC 4226—HOT WATER CIRCULATING PUMP—The "B & G 75" circulating pump, recently introduced by Bell & Gossett Co., Morton Grove, Ill., has ¾ in. flanged connections, a 1/15 hp motor, and two-bolt, forged steel flanges which are said to permit tightening with "little more than finger pressure."

Said to be exceedingly light in construction, virtually noiseless in operation, and to provide unusually large circulation per horsepower, the unit features a ground water tight seal, oil lubrication throughout, and oversized bearings.

Hot Water Circulating Pump



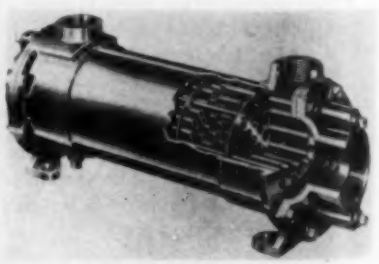
Plug Valve

HPAC 4227—CORROSION RESISTING PLUG VALVE—The "Durco" type B valve is a pressure lubricated plug valve designed for heavy duty corrosive service. It is manufactured by Duriron Co., Inc., Dayton 1, Ohio, and is offered in a wide range of corrosion resisting alloy bodies and plugs.

Hard, hardened, or hard faced plugs have grooves which are cut after grinding and lapping. The "Teflon" diaphragm is said to provide a corrosion resisting, self lubricating seal. The top lubricated model (shown here) has the lubricator in the plug shank, and the bottom lubricated model (used where plugs are too hard to machine readily) is provided with a lubricator in the body below the plug which is flexible jointed.

Both models are available in sizes from ½ to 6 in.

HPAC 4228—STAINLESS STEEL HEAT EXCHANGER—According to Ross Heater & Mfg. Co., Inc., Buffalo 13, N. Y., its new type SSCF heat exchanger is the first all-stainless unit to reach mass production. Immediate delivery and low cost are said to be made possible by standardization and stocking of all parts.



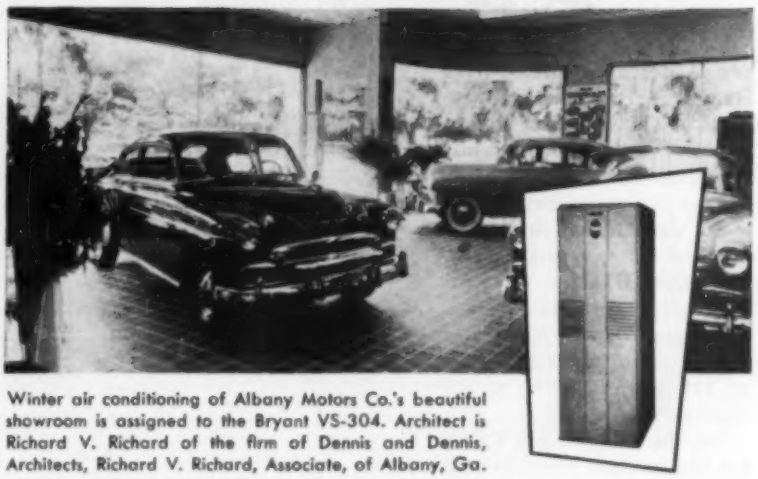
Identical in design and capacities to the firm's type BCF exchanger which is of copper and copper alloys, the new unit is available in a wide range of sizes and is tested to 450 psi. While type 316 is standard, units may be obtained in other well known types of stainless.

Special Assignment

FOR A TRIO OF EXPERTS

Three types of Bryant equipment, all operated on LP-Gas, provide the heating comfort in this newly completed Albany, Georgia, automobile agency. Showroom and offices are winter air-conditioned. Well-placed unit heaters maintain constant comfort in the large service department and garage. An individual heater, which supplies welcome warmth by both radiation and circulation, guards the comfort of mechanics and other employees in their locker and shower room. It's a case where more than one type of heating unit is needed to provide adequate heating, efficiently and economically.

When your heating job requires diversified equipment, specify *all* your needs from the most complete line of gas heating equipment in the nation—the Bryant Line. You get uniform quality in every type of unit, and you're sure of *expert* performance, on any gas, for every Bryant unit is experience-proved. Your Bryant Distributor stands ready to help you select the units that will help you sell your job.



Winter air conditioning of Albany Motors Co.'s beautiful showroom is assigned to the Bryant VS-304. Architect is Richard V. Richard of the firm of Dennis and Dennis, Architects, Richard V. Richard, Associate, of Albany, Ga.

Bryant Model US-322 Unit Heaters get the call for the job of heating Albany Motors' vast service department and garage, part of which is shown above.

Expert on body comfort is the Bryant Model VC-426 Radiant Circulating Heater, installed in employees' locker and shower room. Heating Contractor for Albany Motors Co. building is Vance J. Law of Consumers Gas Company, Albany, Georgia.

Let the pup be furnace man
... and water boy, too!

bryant

AUTOMATIC HEATING

BRYANT HEATER DIVISION

Affiliated Gas Equipment, Inc.

Cleveland, Ohio • Tyler, Texas

THE MOST COMPLETE LINE OF GAS HEATING EQUIPMENT IN THE NATION

See Aldrich at the Dallas Show! See the extra advantages of this complete line of compact boiler burner units for Industrial or home heating and/or hot water supply!

See the Aldrich Series "B" Line – 6 sizes, rating 118,000 to 808,000 BTU an hour for low pressure steam or hot water systems . . . 6 sizes for hot water supply with ranges of 125 to 850 GPH at 100 degrees.

See the Aldrich BANTAM . . . designed especially for the modern low-cost home. With 100,000 BTU an hour rating the Bantam heats 4 to 5 rooms economically – occupies 20 x 33 in. floor space; stands 45 in. high.

All Aldrich boilers are available for either oil or gas firing with burners readily interchangeable.

JOBBERS
DEALERS
...with ALDRICH
you've got what they want!

See for yourself how quickly, easily, oil and gas burners may be interchanged on all Aldrich Boilers. It's a big sales feature – but just one of the many you can use to keep sales at their peak.

See, also, the complete line of Aldrich Oil Burners . . . 4 models, 6 firing ranges, .75 GPH to 19 GPH. Exclusive design and construction features make them ideal for conversion, replacement, or original equipment. See Aldrich at the Dallas Show!

SEE ALDRICH . . .

at the Southwest Air Conditioning Exposition at Dallas, week of January 23. We'll be looking for you . . . and we'll welcome the chance to demonstrate Aldrich superiority, point by point! If you can't make the show, write us for literature describing the Aldrich lines of boiler burners, water heaters and oil burners.

ALDRICH HEAT-PAK PRODUCTS

ALDRICH COMPANY

105 East Williams Street, Wyoming, Illinois

A Subsidiary of Breeze Corporations, Inc.

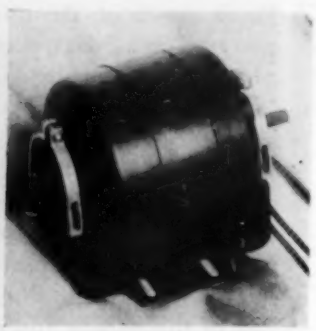
ONE OF THE BREEZE MARK PRODUCTS

HPAC 4229—STEAM PIPING IN RAILROAD PASSENGER CARS—A new "trench piping" method in connection with heating railroad passenger cars has been developed by Vapor Heating Corp., 80 E. Jackson Blvd., Chicago 4, in cooperation with Pullman-Standard Car Mfg. Co.

To reduce high heat loss from steam pipes located under the cars, particularly when the train is moving at high speeds, the piping is now located in an insulated trench in the floor of the car. This, combined with heating the side panels of the car, is said to be a forward step in more efficient heating.

One of the problems which had to be overcome was the design of a steam tight swing joint that would compensate for expansion which takes place in one direction as one end of the pipe is anchored to the car body.

Piping in Railroad Car Floor



Fractional HP Motor

HPAC 4230—FRACTIONAL HORSEPOWER MOTORS—A new line of oil lubricated, shaded pole motors designed for operation in any position has been developed by the fractional horsepower motor divisions of General Electric Co., Schenectady, N. Y.

Designated as type KSP (frame sizes 11 and 21) the new motors are recommended for use in connection with exhaust fans, cooling fans, evaporative coolers, unit heaters, condenser cooling, space heaters, small pumps, agitators, and blowers. Ratings range from 1/40 hp through 1/12 hp at 115 or 230 volts, 1050 or 1550 rpm, 60 cycles.

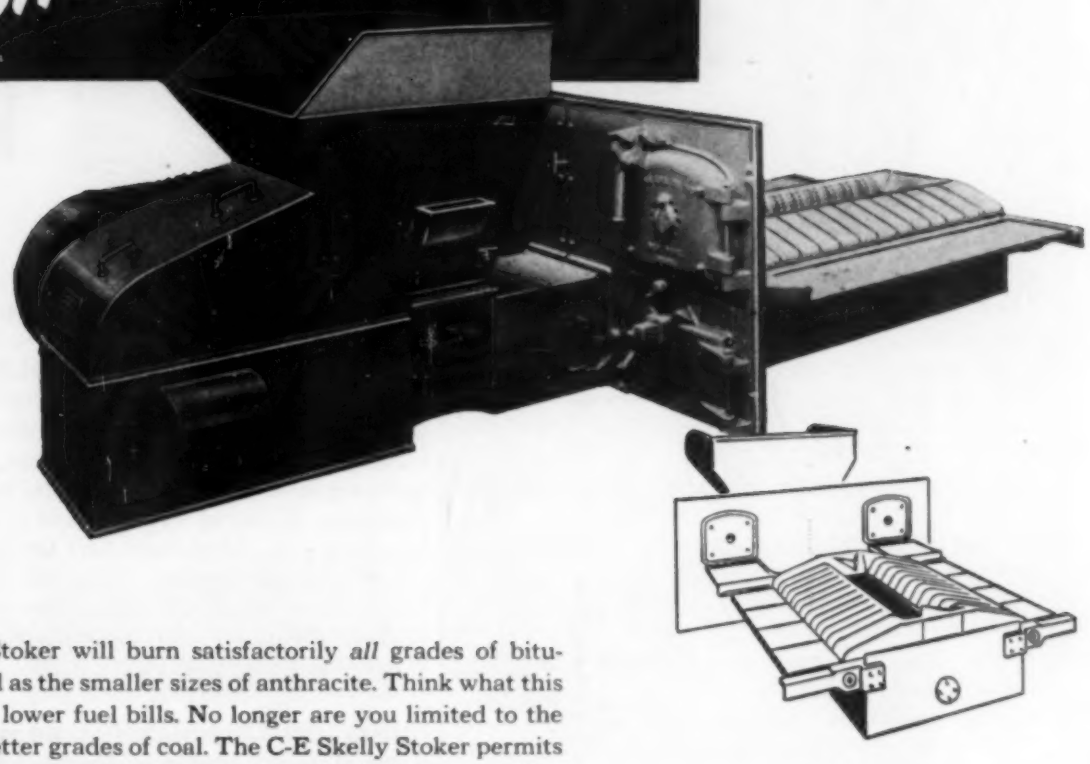
A new lubrication system is designed to provide a constant flow of oil to bearing surfaces regardless of the position of the motor. Oil saturated packing is used to feed the bearing with filtered oil, and according to the company, no additional lubricant is ever required.

HPAC 4231—INDUCED DRAFT FANS—"Pacific-Wing" induced draft fans are available from the Pacific Steel Boiler Div., United States Radiator Corp., 300 Buhl Bldg., Detroit 26.

Advantages are said to include the elimination or reduction in size of stacks, making possible savings in fuel by improved combustion, and making possible advantageous locations of boiler rooms and the addition of boilers where an existing stack would otherwise be inadequate. Installation can be made with a righthand or lefthand breeching connection to the stack with rear breeching connection, and with top outlet for a self supporting stack. Stack sections for the fans are also available for some types of installations.

Why not buy a stoker that will burn either...

Anthracite or Bituminous Coal?



The C-E Skelly Stoker will burn satisfactorily *all* grades of bituminous coal as well as the smaller sizes of anthracite. Think what this means in terms of lower fuel bills. No longer are you limited to the more expensive, better grades of coal. The C-E Skelly Stoker permits the use of the most economical type of coal available in your locality. This flexibility in the choice of coals enables you to keep your heating costs at a minimum. In fact, it makes your purchase an investment rather than an expense.

For, since the cost of fuel burned on a stoker in a single year often greatly exceeds the initial cost of the stoker itself, it is evident that *what kind* of coal a stoker will burn and *how well* it will burn it is a far more important consideration than the purchase price.

Moreover, the C-E Skelly Stoker assures top performance with minimum maintenance. For this stoker reflects the practical knowledge of fuels and operating conditions that Combustion has acquired in installing over 20,000 stokers of *all* types above residence size.

You can turn to C-E with complete confidence that you are purchasing a stoker that you can rely on for years of dependable, economical service. Why not investigate the C-E Skelly Stoker for your next installation? B-362

C-E

COMBUSTION ENGINEERING-SUPERHEATER, Inc.

A Merger of Combustion Engineering Company, Inc. and The Superheater Company

200 Madison Avenue · New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS.

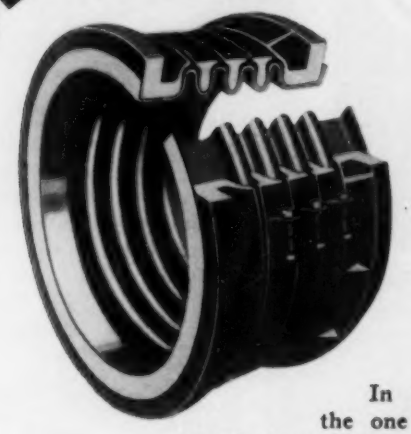
ANOTHER REASON WHY

Badger

IS FIRST IN

expansion joints

FLEXIBLE

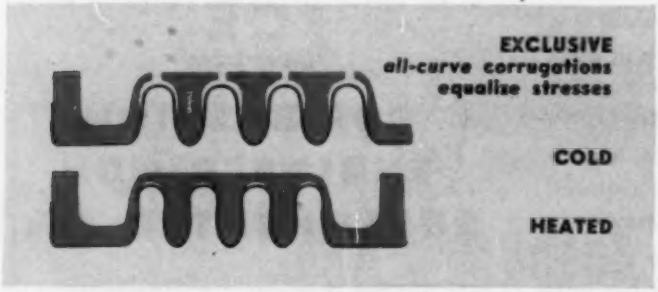


In flexibility — the one most important feature of *any* expansion joint — Badger stands first.

Fast response to the thrust produced by heat expansion means less wear, tear, and breakage on adjacent fittings and equipment. Just one reason why leaders in every field put their faith in Badger Packless Expansion Joints. Here are others:

- Packless . . . single tube construction provides pressure-tight joint without packing
- Compact . . . requires no more space than regular flanged fittings
- Special forming methods . . . no danger of structure-weakening stresses
- Controlled heat treating . . . to assure long life for flexing member
- Fabricated from stainless steel or alloys . . . joints withstand high temperature and corrosion
- Directed flexing rings . . . to equalize stresses *between* and *within* corrugations

These features are important in any pipe line job — you can get them *all* only by specifying Badger Expansion Joints.



Badger

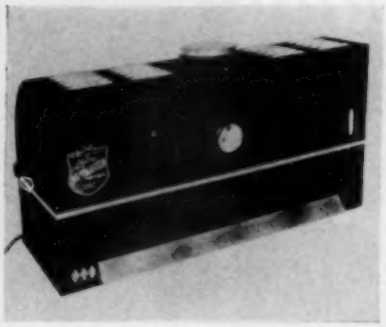
MANUFACTURING COMPANY

230-260 BENT ST. CAMBRIDGE 41, MASS.

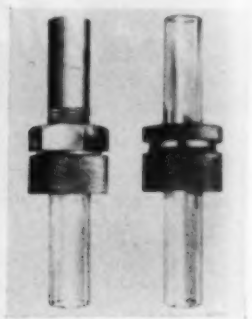
HPAC 4232—GLYCOL VAPORIZER**—The model C-49 "Vapomaster" of M. F. Robertson Sons, Inc., Landowne, Pa., is a glycol vaporizing unit designed to handle up to 5000 cfm and to be adaptable to air conditioning and ventilation systems.

The unit consists essentially of a glycol reservoir, woven glass wicking, and three 75 watt electric lamps. It is equipped with dual control—regulation of the wick cylinders through switches and a damper control which operates simultaneously on all three cylinders. There is no mechanical movement and, according to the company, features include trouble free maintenance, precise control, and simple installation.

It is particularly recommended for use in schools, theaters, hospitals, and special applications in the poultry and animal husbandry field.



Glycol Vaporizor



Glass Pipe Coupling

HPAC 4233*—GLASS PIPE COUPLING—Fischer & Porter Co., Hatboro, Pa., has developed a new threaded metal coupling for use with pyrex glass pipe lines.

Designed to simplify the installation of glass piping by replacing three-bolt triangular metal flanges, the coupling eliminates the use of wrenches and is said to insure perfect alignment. Advantages, says the firm, include reduction of breakage because of uneven take-up and reduction of installation time. Couplings are available in ¼, ½, ¾, and 1 in. sizes for making glass-to-glass or glass-to-metal connections.

HPAC 4234*—MECHANICAL SHAFT SEAL—For installation on equipment moving or transferring liquids, Peerless Pump Div., Food Machinery and Chemical Corp., 301 West Ave. 26, Los Angeles 31, has developed a new mechanical shaft seal designed to provide a mechanical means for prevention of leaks around a rotating shaft.

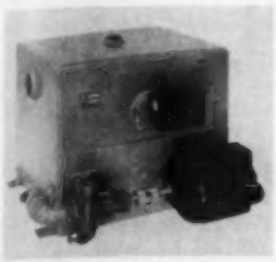
The seal is available in three general classifications, standard, abrasive resistant, and special. The standard seal is for use when a limited amount of abrasive material is present; the abrasive resistant seal is designed for all abrasive liquid conditions; and the special seal is for unusual fluid conditions.

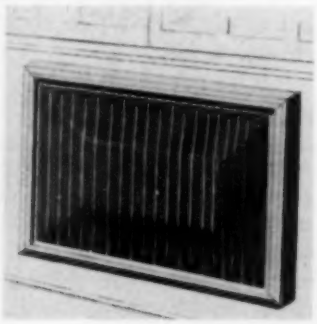
The new mechanical shaft seal is of the cartridge type and is recommended for use with water, gasoline, alcohol, hydraulic fluids, ammonia, and brines, as well as concentrated or boiling acids and salts.

The maximum pressure recommended is 400 psi. Higher pressures require a special balance check. Liquids can be handled at temperatures up to 250 F with no water cooling; with water cooled stuffing boxes, liquid temperatures up to 300 F can be handled. Seals can be furnished for all rotating shafts ½ to 3 in. in diameter.

HPAC 4235—CONDENSATE PUMP UNIT—The new "Eagle" condensate pump unit of Walter H. Eagan Co., Inc., 2336 Fairmount Ave., Philadelphia 30, is designed to handle 8000 sq ft EDR at 20 psi.

Features are said to include a 2 in. inlet only 12 in. from the floor, an all-bronze centrifugal pump connected to a ⅓ hp motor by a flexible coupling, and a level indicating, two pole float switch. The motor is equipped with thermal overload protection.



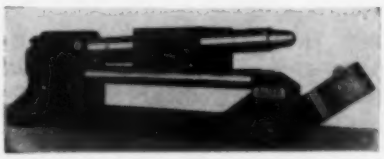


Left: Condensate Return Unit
Right: Glass Radiant Heat Panel

HPAC 4236—GLASS RADIANT HEAT PANELS**—Appleman Glass Works, Bergenfield, N. J., has introduced "Electriglas" radiant heat panels in both permanent and portable models.

A metallic alloy grid, fused into "Temprex" glass, is heated by an electric current and generates infrared heat. Unusual efficiency is claimed by virtue of the physical composition of the glass and special curved construction of the panels. The glass is said to be five to seven times stronger than ordinary glass and to be practically indestructible. Units are designed to operate with either a-c or d-c current, 110 or 220 volts.

HPAC 4237*—ROLL PRESS—The "Alten" hydraulically powered roll press is a multi-purpose machine which is basically a pyramid type plate bending roll. According to the manufacturer, Altens Foundry & Machine Works, Inc., Lancaster, Ohio, it incorporates the advantages of a pinch type bending roll, may be converted into a press brake, and with fixtures between the the upper and lower rolls, may be used for punch press work.



The machine can be equipped with a sub-base and cylinder arrangement to convert the rolls from the conventional horizontal type to rolls of the vertical type. A feature of the unit is said to be the savings in floor space because of the direct hydraulic operation which eliminates gear reductions, pulleys, clutches, etc.

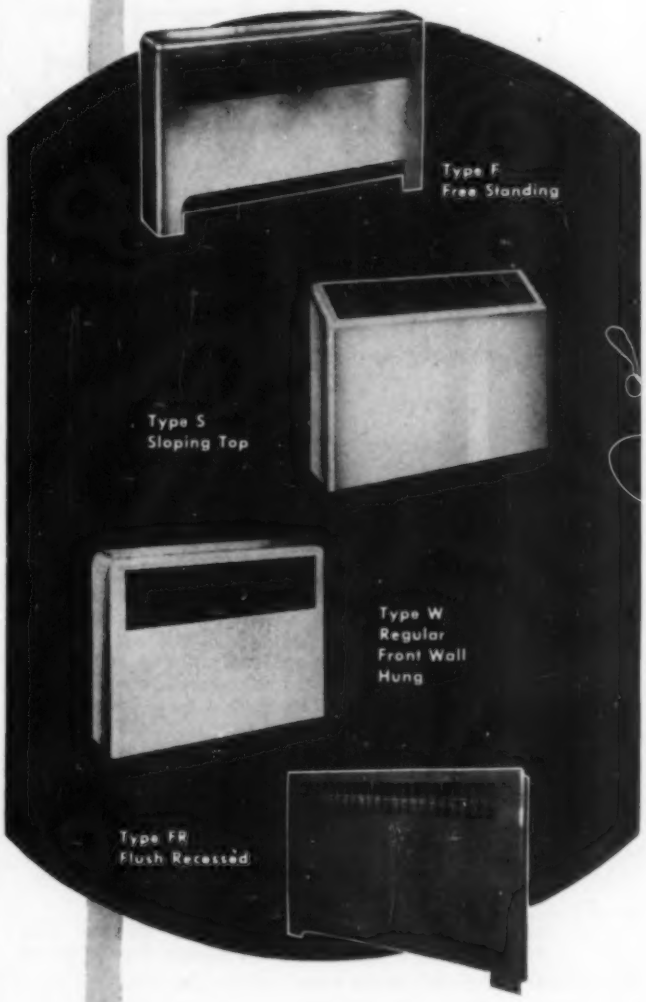
Built in six standard sets, the roll press is offered in a variety of sizes for rolling plate from ⅛ in. to 1¾ in. thickness.

HPAC 4238—ALUMINUM SHEATHING FOR PIPE INSULATION**—For low cost sheathing of insulated pipe lines in refineries and industrial plants, Childers Mfg. Co., Houston, Tex., has recently developed a combination weather resistant barrier and jacket of aluminum foil.

Attractively Designed

AIRTHERM CONVECTORS

Quick... Easy to Install



Attractive design and outstanding performance have resulted in an increasing preference for Airtherm Convectors in institutions, apartments, homes and schools. Quick, easy installation plus increased customer satisfaction enables you to make more money on each job with Airtherm Convectors.

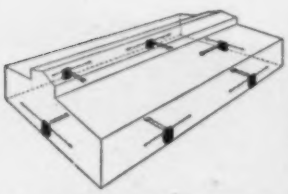
Try them — on your next job.
Write for Bulletin No. 701.

AIRTHERM MANUFACTURING COMPANY
711 South Spring Avenue • St. Louis 10, Missouri

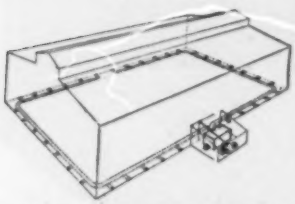
Direct Fired

WARM AIR HEATERS by LEE

a COMPLETE line for every application



One or more heaters is placed inside of the space to be heated.

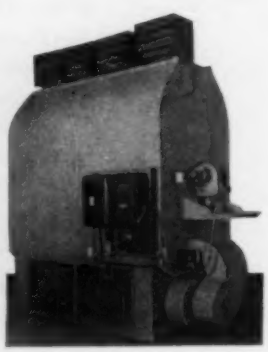


Heater is placed in a central location, warm air being delivered by ducts to space heated.

Whatever your needs in large scale heating you will find a Lee Direct Fired Unit to handle the job efficiently and economically. Over thirty years of experience in building quality heaters guarantees the proper unit for the job whether you contemplate a unit or central system. Illustrated at left are the two types mentioned — the top diagram shows an installation using one or more heaters in which capacities from 300,000 to 6 million Btu may be obtained. The bottom diagram illustrates the central system in which the heated air is distributed through ducts in which 3 million to 8 million Btu may be developed.

The efficiency of the Lee counter-current flow reduces fuel consumption; while the rugged simplicity of the system decreases cost of installation, assures low maintenance charges, and also provides ventilation without additional cost. In addition to normal heating installations Lee Direct Fired Units may also be used for drying and curing in cases where these two operations are required.

It will pay you to investigate the Lee line today—literature is available describing completely the principal types of construction and versatility of operation as well as a partial list of prominent and satisfied Lee customers.



Please write us today.

LEE ENGINEERING COMPANY

95 River Street **Hoboken, N. J.**

The new product consists of 0.0055 in. corrugated aluminum foil bonded to an insulating barrier. It is shipped in rolls 4 ft wide and 100 ft long and is cut and applied on the job. Advantages are said to include ease of application, weatherproofness, elimination of painting or other surface coating, and permanence.

The combination aluminum jacketing and barrier is attached in one operation, and is applied around turns, flanges, and connections. Most applications are secured with a plastic film tape. Others use aluminum fastening strips and sheet metal screws. The foil is made by Aluminum Co. of America, the plastic film tape by Minnesota Mining & Mfg. Co.

Equipment Shorts

International Nickel Co., Inc., New York, has been granted patents on a new ductile cast iron developed by the company. The iron is said to combine the processing advantages of cast iron, such as fluidity, castability, and machineability with the advantages of steel. The essential feature is the introduction into and the retention by the molten iron under treatment of a small amount of magnesium which produces a new graphite structure. More than 40 companies in many industries are now licensed to produce the magnesium treated cast iron which is expected to assume an important role in industry.

A campaign to increase sales of air conditioning equipment during the "off season" winter months has been initiated by **Carrier Corp.**, Syracuse, N. Y. The drive stresses the benefits of year 'round conditioning and the fact that installations can be made more conveniently and at lower cost during the winter. Emphasis is placed on the fact that air conditioning is more than cooling.

A one story, Minneapolis factory building containing 102,000 sq ft has been purchased by **Minneapolis-Honeywell Regulator Co.**, Minneapolis. It will accommodate expansion of the special products division which manufactures aeronautical control devices. M. P. Fedders, general superintendent of manufacturing at the firm's Minneapolis plants since 1945, has been promoted to plant manager of the division.

Last month when the 110-day work stoppage ended at the engineering works division of **Dravo Corp.**, Pittsburgh, company officials announced that production facilities for direct fired air heaters had been more than doubled to fill a heavy backlog of orders and to meet an increased seasonal demand.

Modine Mfg. Co., Racine, Wis., recently shipped 30 unit heaters to the Army Air Force base at Scott Field, Ill. A large project, undertaken at the base, entailed the remodeling of a 500-man barracks into a headquarters building. Since the entire project had to be completed in a week's time, the heaters were rushed to Milwaukee by transport truck and then loaded on a plane for a quick flight to the air field.

Cooper Alloy Foundry Co., Hillside, N. J., will hold a stainless steel valve clinic January 12, at the William Penn hotel, Pittsburgh. In the form of a dinner and technical meeting, the clinic will include discussions of

NEW, IMPROVED FIBERGLAS DUCT INSULATIONS...

Two types...for any job

FLEXIBLE AEROCOR

The new, blanket-type insulation, made in a variety of densities and thicknesses to effectively insulate round ducts and irregular-shaped equipment, is a superfine material having an exceptionally high ratio of insulating value to weight.

Fiberglas* "Aerocor*" Insulation comes in rolls up to 200 feet in length and is available in five standard widths and thicknesses. Can be applied rapidly with standard tools and methods.

Aerocor has a k-factor as low as 0.23 at 75° F., mean temperature, weighs as little as 0.3 pound per cubic foot. Its glass fibers cannot rot or mildew, cannot support combustion or sustain rodents.

Ask the local Fiberglas Sales Office for complete information and data on Fiberglas Aerocor Insulation.

COATED DUCT INSULATION

Use this semi-rigid board material as a thermal or acoustical insulation on square ducts and flat surfaces. Can be used either inside or outside ducts, with complete fire safety. When applied *inside* ducts to deaden noise, this insulation will withstand air velocities up to 6,000 feet per minute without eroding.

It's easy to cut to shape with a knife, can be applied either with adhesives or by mechanical fasteners. Has strength to support its weight, is readily finished and painted without preliminary preparation.

Like all Fiberglas Insulations, its glass fibers will not support combustion or sustain rodents, cannot rot or mildew.

Get complete information and data sheets on both these Fiberglas Insulations by phoning the local Fiberglas Sales Office in leading cities.

Or write to OWENS-CORNING FIBERGLAS CORPORATION, Dept. 911, Toledo 1, Ohio.

OWENS-CORNING
FIBERGLAS

THERMAL INSULATING MATERIALS

*Fiberglas (Reg. U. S. Pat. Off.) and Aerocor are the trade-marks of Owens-Corning Fiberglas Corporation for products made of or with glass fibers.

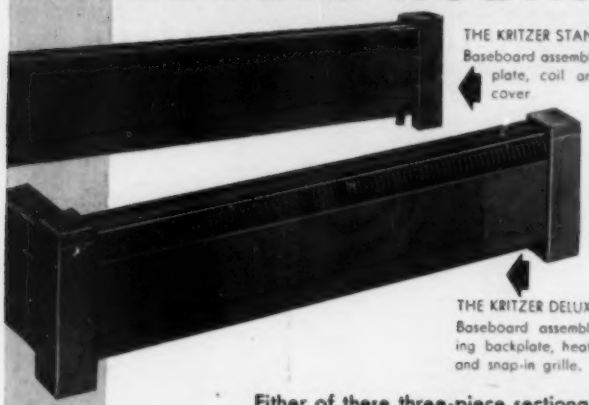
Address: OWENS-CORNING FIBERGLAS CORPORATION, Dept. 911, Toledo 1, Ohio. ***Branches in principal cities***

Modern Heating at its best . . . . . but definitely on the economy side!

for less cost and greater sales appeal use

Kritzer

baseboard heating



THE KRITZER STANDARD Baseboard assembly; backplate, coil and front cover

THE KRITZER DELUXE Baseboard assembly showing backplate, heating coil and snap-in grille.

Either of these three-piece sectional units provides the simplest kind of installation . . . cuts labor time in half.

Here are BTU's more efficiently delivered; heat more evenly distributed and rooms with warmer floors.

Attractive too; . . . as the component parts are engineered with Kritzer skill to replace in size and design the conventional wooden baseboard.

3 easy steps take care of the installation work.

1 Back cover plate with integral hangers for coil is attached.

2 Coil is hung and connected . . . in sections with solder ring . . . no fittings.

3 Front cover plate is snapped on and you're finished.

IF IT'S KRITZER IT'S RIGHT SIR

. . . so get the facts right away. Send this coupon for ratings, construction data and the remarkably simple installation details.

KRITZER RADIANT COILS, INC.
2905 W. Lawrence Ave., Chicago 25, Ill.

Gentlemen: I'm interested. Please send complete information and bulletin on Kritzer Standard and Deluxe Baseboard Heating.

Name.....

Firm.....

Address.....

City..... Zone..... State.....

valve types, applications, design features and maintenance factors, materials of construction, etc. Admittance is by invitation only and is limited to those in the Pittsburgh area who are directly concerned with purchasing, specifying, or maintaining corrosion resistant valves.

A network of authorized service stations in all principal cities has been established by **Penn Electric Switch Co.**, Goshen, Ind. Service personnel in all stations are given an intensive course of factory training and all stations are authorized to make immediate replacements under terms of the company's warranty and also flat price replacement plan. ..... **Marlo Coil Co.**, St. Louis, has reduced the price of ammonia coils for ammonia industrial coolers approximately 20 percent and has reduced prices on all ammonia evaporative condensers approximately 7 percent. These reductions are said to be in line with recent reductions in the price of hot galvanizing.

Over 400 guests recently attended the formal opening of the new Flushing, N. Y., plant of **Eutectic Welding Alloys Corp.**, New York City. ..... A mechanical "watchdog" will guard motorists against dangerous concentrations of carbon monoxide in the 2000 ft long West Rock Tunnel along the Wilbur Cross Parkway at New Haven, Conn. According to the manufacturer, **Mine Safety Appliances Co.**, Pittsburgh, the instrument will be used to control the tunnel ventilation system and will continuously sample air from near the tunnel entrances and will check it for carbon monoxide.

At the recent 6th All-Industry Refrigeration and Air Conditioning Exposition, **Carrier Corp.**, Syracuse, exhibited transparent plastic casings on models of its "Weathermakers" and room air conditioning units so visitors could actually see water forming on coils and dropping into drainage systems as moisture was removed from the air. Dirt and dust taken from the air could also be seen on the outside of the filters. A cutaway model of a 15 hp compressor was provided with a crank for manual operation to demonstrate the action of the inner mechanism.

A new aluminum-on-steel combination, said to give promise of wide usage, has been announced by **Reynolds Metals Co.**, 2500 S. Third St., Louisville, Ky. A fine iron coating is applied to the sheet steel by an electrolytic process to provide a permanent bond between the steel and aluminum surfaces. Two strips of aluminum foil are then applied to both sides of the steel sheet. .....
A new line of buffer solutions for calibrating any pH instrument is available from **Leeds & Northrup Co.**, 4934 Stenton Ave., Philadelphia 44. Nominal pH values are 4, 7, and 9. The buffers are made and checked, after bottling, to National Bureau of Standards specifications.

Bridgeport Brass Co., 30 Grand St., Bridgeport 2, Conn., is marketing copper tube especially for refrigeration and related use. The new tube is available in standard sizes from ⅛ to ¾ in OD and comes in 50 ft coils, dehydrated and sealed, with each coil packed in a separate carton. According to the company, the tube is uniform in size and has a uniformly soft temper.

SOLVE DIFFICULT

STACK PROBLEMS

this

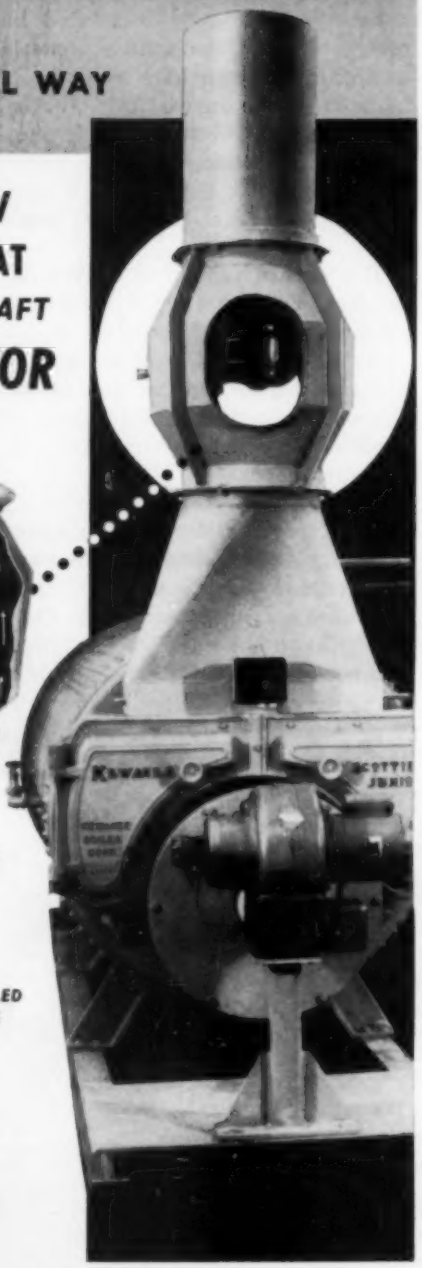
ECONOMICAL WAY

with NEW

DeBOTHEZAT

INDUCED DRAFT

BIFURCATOR FAN



- OFTEN ELIMINATES COSTLY STACK CONSTRUCTION
- PERMITS CONTROLLED DRAFT REGARDLESS OF WEATHER
- SAVES SPACE AND OPERATES MORE EFFICIENTLY than CENTRIFUGAL FAN

DeBothezat Induced Draft Bifurcator Fans can be installed in vertical stack or horizontal or angular breeching. The Bifurcator is a direct motor driven fan with a divided housing. Gases by-pass motor which is isolated in through-ventilated, asbestos lined chamber. For operating temperatures up to 650° F. Also special construction for higher temperatures.

Fan can be connected to firing controls, for uniform draft. Motor easily accessible. No belt, countershafts or platforms required.

FAN SIZES 12" THROUGH 27". For Boilers from 6 HP (200,000 BTU per hour) up to 350 HP (12,000,000 BTU per hour).

Write today for complete details and prices.

DeBOTHEZAT FANS DIVISION

AMERICAN MACHINE AND METALS, INC.

Dept. H-12, East Moline, Illinois

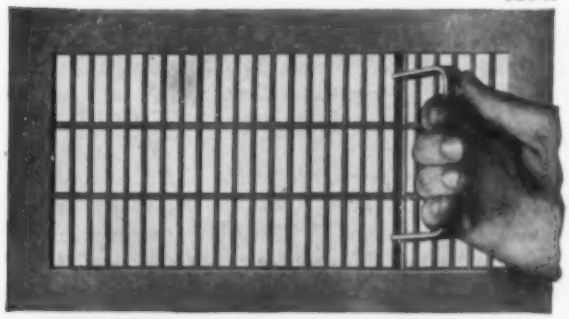
INDEPENDENT

"Fabrikated" WALL GRILLES

for Commercial Installations

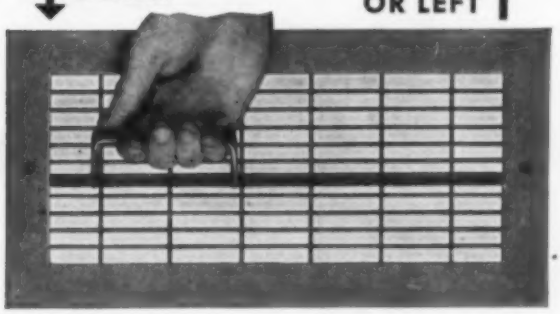
PROVIDE ADJUSTABLE DIRECTED AIR FLOW

321-A



UP OR DOWN

RIGHT OR LEFT



311-A

Made to fit openings in even inches from 8" x 4" to 60" x 40"

Independent Fabrikated* Adjustable Grilles (patented), rigidly constructed with stamped steel rims and steel bars, are made with either vertical or horizontal grille bars. Grille bars are *adjustable* before or after installation; available also with bars permanently set for straight flow.

Write for new Catalog No. 48—gives schedule of sizes, details and prices.

Always Leading — Always Progressing

*Reg. U. S. Pat. Off.

THE INDEPENDENT REGISTER CO.

3747 E. 93rd STREET · CLEVELAND, OHIO

Drayer-Hanson, Inc., Los Angeles, reports a backlog of orders for the first time since the days immediately following the end of the war. Fourth quarter bookings are 15 percent ahead of those for the same period last year. Tooling has recently been completed for a new line of air conditioning coils featuring staggered tubes, aluminum fins, and improved casings. ..... **Frick Co.**, Waynesboro, Pa., has moved its Boston office to 419 Commonwealth Ave.

Permanente Metals Corp., Oakland, Calif., has changed its corporate name to **Kaiser Aluminum & Chemical Corp.** in order to achieve a closer identification with its principal products. In addition, the wholly owned sales subsidiary, **Permanente Products Co.** has been renamed **Kaiser Aluminum & Chemical Sales, Inc.** Orders received for last month are said to have set an all-time company record. ..... **C. A. Dunham Co.**, Chicago, recently conducted a series of five regional sales meetings held in Chicago, Los Angeles, Portland, Ore., New York City, and New Orleans. A total of 100 sales engineers participated.

"Tygon" paint coating, series K, is offered by **U. S. Stoneware Co.**, Akron, Ohio, as an easily applied, self priming vinyl base paint for resisting corrosive conditions not sufficiently severe to warrant the use of the company's multiple coat series of paints. It may be brushed, sprayed, air dried, or baked and is said to resist fumes of almost all acids and alkalis, as well as excessive humidity, grease, oil, and alcohols. It is also said to adhere tightly to metal, wood, or concrete.

"Phenoplast" is a new plastic finish said to withstand unusual temperature ranges and to be unaffected by practically every acid and chemical solvent, water, gasoline, oils, alkalies, salt spray, and strong brines. It is also said to penetrate and harden as a physical part of a porous surface. It is applied like varnish to wood, metal, tile, and composition materials and may be used as a glue. **L. Sonneborn Sons, Inc.**, 80 Eighth Ave., New York 11, is the distributor. . . . **Air Reduction Sales Co.**, 60 E. 42nd St., New York 17, is offering a new a-c transformer arc welding machine known as the "Wilson 22 Amp Max. MCT." The unit is portable and is designed for use in small shops and by maintenance crews.

The newest fastener of **Parker-Kalon Corp.**, 200 Varick St., New York, is a self tapping screw with a socket head marked to identify the size. It is a combination of the size-marked socket head common to the firm's cap screw and the thread body of its regular type F self tapping screw. It is said to be satisfactory for many socket screw applications which do not require exceedingly high stress concentrations.

The type M thermostat, a compact quick make and break unit designed for close temperature control of electronic devices, appliances, and industrial apparatus, is available from **Stevens Mfg. Co., Inc.**, Mansfield, Ohio. It employs a bimetal thermal element of disc construction and is offered in a variety of terminal arrangements. The maximum operating temperature is 600 F and temperatures as low as —60 C do not impair normal operation, according to the company.

These **2 THERMOBLOCS**

... offer the Flexibility you need for Heating Your Plant!

Total outputs up to millions of b.t.u.'s per hour can be obtained with combinations of these two THERMOBLOC sizes. Units of these sizes, placed strategically throughout the plant, will maintain uniform temperatures without costly piping or duct work.

Original cost and installation of THERMOBLOC is approximately one-third that of other types of conventional systems, and a notably higher overall efficiency of 82 to 86% results in required temperatures at a lower fuel consumption rate.

A new THERMOBLOC bulletin, just off the press, provides engineering data for estimating heating requirements for your plant. Write today for your copy.

ONE No. 550 THERMOBLOC EQUALS
550,000 b.t.u.'s per hour
2290 sq. ft. of radiation
567 pounds of steam per hour
16.4 developed boiler horse power

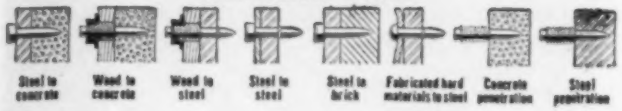
ONE No. 300 THERMOBLOC EQUALS
300,000 b.t.u.'s per hour
1250 sq. ft. of radiation
309 pounds of steam per hour
8.96 developed boiler horse power

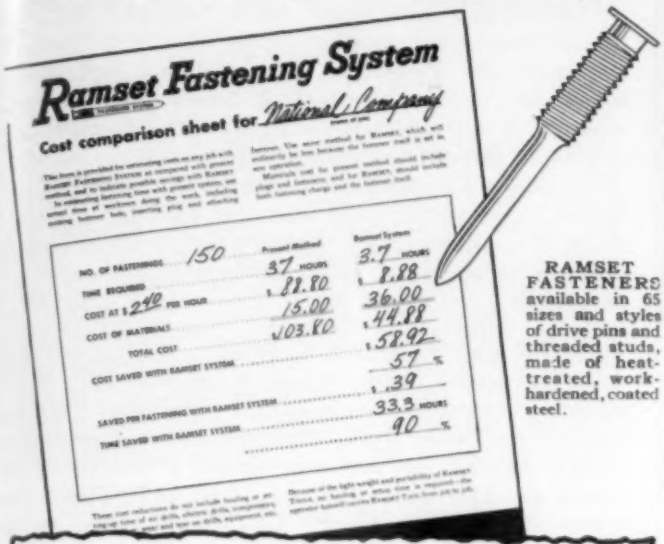
THERMOBLOC DIVISION

PRAT-DANIEL CORPORATION

Manufacturers of P-D Power Equipment • 70-12 Water Street, East Port Chester, Conn.

SAVE MONEY, TIME, TROUBLE ON FASTENING JOBS LIKE THESE WITH RAMSET SYSTEM




Ramset Fastening System

Cost comparison sheet for National Company

	Present Method	Ramset System
NO. OF FASTENINGS	150	
TIME REQUIRED	37 HOURS	3.7 HOURS
COST AT $2.40 PER HOUR	$ 88.80	$ 8.88
COST OF MATERIALS	15.00	36.00
TOTAL COST	$103.80	$ 44.88
COST SAVED WITH RAMSET SYSTEM		$ 58.92
		57 %
SAVED PER FASTENING WITH RAMSET SYSTEM		$ .39
TIME SAVED WITH RAMSET SYSTEM		33.3 HOURS
		90 %

RAMSET FASTENERS available in 65 sizes and styles of drive pins and threaded studs, made of heat-treated, work-hardened, coated steel.

FIGURE OUT FOR YOURSELF WHAT Ramset CAN SAVE!

Select any job of fastening or anchoring into steel, concrete, masonry or other materials as shown above. Then, use RAMSET'S free Cost Comparison Sheet to compare slow, laborious, costly chipping and plugging, drilling and tapping with the amazingly fast, simple, economical RAMSET FASTENING SYSTEM.

Thousands of RAMSET users are profiting every day from big savings on their fastening jobs. That's because it takes less than a minute, from start to finish to *"Ramset"* a drive pin or threaded stud, to fasten materials together or to provide an anchor. Just READY! RAM! SET! Quick as lightning, the simple, self-powered, easy-to-use RAMSETTER does the work.

INVESTIGATE RAMSET! Save money on present jobs, slash costs below competition on work you are estimating. *"Ramset"* your way into more business. Ask your local RAMSET dealer or write us for details and free Cost Comparison Sheets.

Stemco Corporation, Cleveland 16, Ohio

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YOU CAN FASTEN FASTER, EASIER, AT LESS COST WITH Ramset FASTENING SYSTEM

for • SPRAYING
• WASHING
• RINSING
• COOLING
• AIR CONDITIONING

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SPRAY NOZZLES

FAN-TYPE FOR FLAT SLICING SPRAY

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. Write for Bulletin N-616.

YARNALL-WARING COMPANY
107 Mermaid Avenue Philadelphia 18, Pa.

WHO'S WHAT

Rolland J. Hamilton, well known in the heating industry for over 40 years, has retired as vice president of **American Radiator & Standard Sanitary Corp.,** Pittsburgh. Though stepping aside in accordance with the company's retirement plan, he continues on the board of directors and on the executive committee. He is also president and trustee of the John B. Pierce Foundation. **Thomas Hannah, Jr.,** who has been with the firm for the past 22 years, has been promoted from manager of the Washington, D. C., sales office to manager of the central business contact department.

As the new vice president in charge of research for **The Austin Co.,** Cleveland, **A. T. Waidelich** is supervising plant location surveys and economic and engineering reports, as well as the firm's independent research projects. He has been assistant director of research since 1941. ..... **Bell & Gossett Co.,** Morton Grove, Ill., has named **A. B. Meeg** manager of national accounts. He was formerly manager of the industrial control division of Perfex Corp.

Marvin W. Smith, president, Baldwin Locomotive Works, has been elected a director of **Westinghouse Electric Corp.,** Pittsburgh. Before becoming a Baldwin executive, he had been with Westinghouse for 33 years. **Harry J. Deines,** an advertising executive with nearly 20 years of experience in the electrical manufacturing field, is now manager of advertising and sales promotion. ..... Now on the board of directors of **Edwin L. Wiegand Co.,** Pittsburgh, is **Bruce A. Fleming,** vice president in charge of sales. He joined the firm in 1940 as assistant to the president.

Air Reduction Sales Co., New York, has made a number of management changes. **H. R. Salisbury,** with the firm in various executive capacities for over 23 years, is now president. Appointed vice presidents are: **H. F. Henriques** (general sales), **J. J. Lincoln, Jr.** (railroad sales and sales services), **S. B. Stouffer** (distribution), and **N. L. Wisser** (field office management). .... **Blaw-Knox Co.,** Pittsburgh, has named **N. B. Ornitz,** vice president, as manager of foundry operations in the Pittsburgh district. This is a new position created in connection with an improvement program underway in three foundry plants.

O. B. J. Fraser, assistant manager, development and research division, International Nickel Co., Inc., is the recently elected president of the **American Welding Society,** and **A. F. Davis,** vice president and secretary, Lincoln Electric Co., has been elected a director of the society for 1949-52. ..... **A. F. Zissler** has represented **Peerless Electric Co.,** Warren, Ohio, in the Rochester, N. Y., territory for the last 11 years. He is now executive vice president and general manager and is located at the headquarters office.

The newly created position of general sales manager of the **Western Brass Mills, Div., Olin Industries, Inc.** is occupied by **David T. Marvel.** He was formerly manager of sales, Tubing Specialties Div., National Tube Co.

...Digging for facts

ON AUTOMATIC REGULATING VALVES?

YOU'LL FIND THESE KLIPFEL BULLETINS PRACTICAL, FACTUAL AND USEFUL!

Klipfel engineers have put a lot of experience and research into these bulletins to make them useful to you . . . the man who uses or specifies automatic regulating valves. Each bulletin covers such points as: the advantages and limitations of different valve constructions; selecting the proper type valve for given operating conditions; determining the most effective and economic size valve for the job.
In short, Klipfel engineers have prepared these bulletins to assist you in selecting the type and size valve best suited to your needs.
Write Dept. C-12 for any bulletins you wish. We'll gladly send them to you.

KLIPFEL REDUCING VALVES

for steam, air and water . . . in lever and weight, air loaded, pilot control and spring loaded types; descriptions, illustrations and complete selection data in Bulltin 148.

KLIPFEL FLOAT VALVES

Single and double seated types with direct action or pilot control for remote location. Types shown include quick-acting valves; all are available in angle and globe patterns. Bulletin 349.

KLIPFEL THERMOSTATIC VALVES

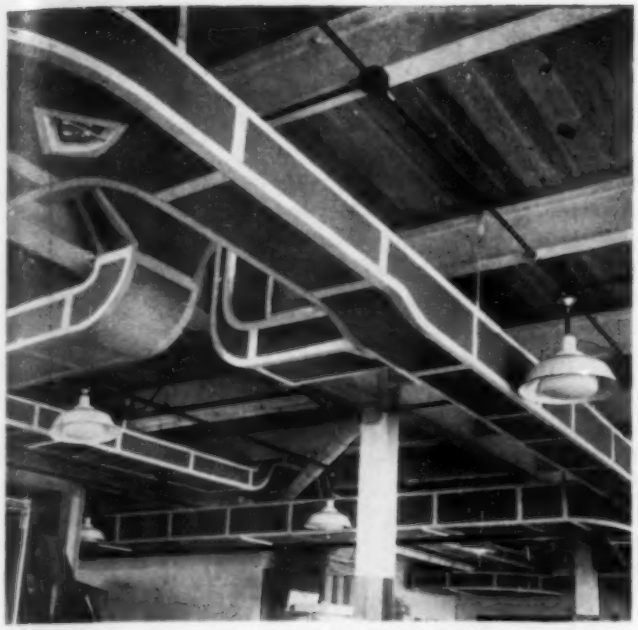
vapor pressure operated valves with spring or weight and lever loading. Valves are ball type, balanced cup and disc or balanced inner valves. Min. temp. 80°. Max. temp. 250°. Range limit of any instrument 40°.

KLIPFEL BACK PRESSURE AND RELIEF VALVES

for control of air, steam and water pressures at the valve inlet in various types for practically any service. Bulletin 648 gives complete details including dimensions and capacities.

Klipfel VALVES INCORPORATED

DIVISION OF HAMILTON-THOMAS CORPORATION, HAMILTON, OHIO



Architects and Engineers:

SPECIFY FUEL SAVINGS PLUS... with DUX-SULATION

Fuel costs for heating commercial and industrial buildings are rising at an alarming rate! Heating costs are big costs . . . regardless of the type of fuel.

Insure substantial fuel economies for your client by specifying asbestos protected *Dux-Sulation* for all metal heating and return air ducts!

Dux-Sulation offers the following 9 outstanding advantages:

1—Saves 75% of Duct Heat Loss
2—Deadens Irritating Duct Noises
3—Offsets Overloads
4—Improves Appearance
5—Reduces Power Load
6—Prevents Condensation
7—Prevents Rust
8—Absorbs 70% of Air-borne Noises
9—Reduces Vibration

SAVES INSTALLATION COSTS—No screws, lugs or bolts are needed. Only asbestos protected *Dux-Sulation* comes in easy-to-handle rolls . . . complete with ready-to-use adhesive and asbestos protected tape for sealing joints and corners. *Dux-Sulation* applies faster . . . saves time and labor costs . . . actually costs less.

For complete facts on all performance advantages, application methods and other data, send today for "Bulletin 412-HP". We will also send you the new sample kit (right) which includes actual samples of *Dux-Sulation*.

We Have Jobbers in Principal Cities

GRANT WILSON, INC.

Board of Trade Bldg. CHICAGO 4, ILL.
141 W. JACKSON BLVD. AT LA SALLE ST.

ASBESTOS PAPER	ASBESTOS MILLBOARD	FLEXIBLE DUCT CONNECTIONS
FURNACE CEMENT	PIPE COVERING	
PIPE JOINT TAPE	BOILER CEMENT	BOILER & TANK INSULATION
COLD WATER PASTE	ASBESTOS SPECIALTIES	

JOHN ZINK CONVERSION BURNERS

Available In Two Models

Luminous Flame Model Illustrated

LUMINOUS FLAME MODEL

Easy to install. Operates manually or automatically. Burns clean fuel—natural, mixed, manufactured or LP gases — without soot or smoke. Luminous flame radiates heat two to three times faster than a blue flame. Four sizes available for either vertical or horizontal firing.

BLUE FLAME MODEL

Designed to meet the requirements of this type of burner. Capacity range of 100,000 to 200,000 Btu/hr. for operation on natural, mixed or manufactured gases. Manual or automatic operation. Easy to install.

JOHN ZINK UNIT HEATERS

Whisper Quiet Model

WHISPER QUIET MODEL

For installations requiring quiet operation. More Head Room — Compact Design and More Heat From Gas Burned. A. G. A. approved for natural, manufactured, mixed or LP gases. Fully equipped with Automatic Controls.

HURRICANE MODEL

For Industrial Installations. This model is also compact in design, offering more Head Room and More Heat from Gas Burned. Will heat 40' x 80' space. A. G. A. approved for natural, manufactured, mixed or LP gases. Automatic Controls.

100,000 Btu/hr.

Both Models finished in Toast Tan Crinkle Enamel Baked on. Adjustable Louvers.

Write for Literature

John Zink Company

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TULSA, OKLAHOMA

New York — Salt Lake City — Houston — Los Angeles

Western Brass maintains two principal plants, one at East Alton, Ill., and the other at New Haven, Conn. Mr. Marvel is making his headquarters at the former. .... **David Lewis,** former executive with Noma Electric Corp., is the new general sales manager for **Lycoming-Spencer Div., Avco Mfg. Corp.,** Williamsport, Pa. His appointment is said to be in line with a program to cover expanding business and the addition of new products.

Frank J. Nugent is now managing sales of heating equipment for **Ingersoll Steel Div., Borg-Warner Corp.,** Chicago. He is president of the Gas Appliance Manufacturers Association and was formerly sales promotion and advertising manager for Bryant Heater Co. and general sales manager, Appliance Div., Rheem Mfg. Co. .... **Walter E. Hoadley, Jr.,** is now company economist for **Armstrong Cork Co.,** Lancaster, Pa. He had been senior economist of the Federal Reserve Bank of Chicago.

Following his resignation as director of engineering for the Atomic Energy Commission, **Roger S. Warner** has joined the staff of **Arthur D. Little, Inc.,** Cambridge, Mass., research and engineering organization. .... Newly elected officers of the **American Gas Association** include: president—**Hugh H. Cuthrell,** vice president, Brooklyn Union Gas Co.; first vice president—**D. A. Hulcy,** president, Lone Star Gas Co.; second vice president—**George F. Mitchell,** president, Peoples Gas Light & Coke Co.; treasurer—**Edward F. Barrett,** president, Long Island Lighting Co.

Marshall F. Allen, formerly executive secretary, National Aircrafts Standards Committee, a subsidiary of the Aircraft Industries Association, is now manager of the **Magnesia Insulation Manufacturers Association.** He succeeds **Utley W. Smith** who resigned to accept a position with **Ehret Magnesia Mfg. Co.** ..... **Cooper Alloy Foundry Co.,** Hillside, N. J., has promoted **Jack Victorine** and **Morton C. Meyers** to the positions of general sales manager and assistant sales manager respectively. Both men have been with the company many years. **J. L. Lessman,** who joined the firm in 1946 as assistant foundry superintendent, is now manager of valve and fitting sales.

Owens-Corning Fiberglas Corp., Toledo, has appointed three new branch managers. **Harold D. Bates,** formerly general merchandising manager, Philip Carey Mfg. Co., is in charge of the New York office. **Russell R. Galloway,** now managing the Chicago branch, was formerly president of Smith Asbestos Co. **John J. Hartnett** heads the Detroit office. He was formerly general sales manager of Certain-teed Products Corp.

Harold D. Gobble, formerly manager of the oil field division of **Fairbanks, Morse & Co.,** Chicago, is now managing the Dallas, Tex., branch office. He succeeds **Harry J. Renken** who has been transferred to company headquarters to become oil field division manager. ..... **Platecoil Div., Kold-Hold Mfg. Co.,** Lansing, Mich., has made a number of recent personnel changes. **Clayton P. Yoder,** who formerly operated his own electric heating equipment and utility line materials

You Benefit from

AEROFIN'S Unequaled Experience in Design and Manufacture of FIN-TYPE Heat Exchangers

For over 26 years, Aerofin — pioneer manufacturer of fin-type heat-transfer surface — has been accumulating an unequalled experience in the design and fabrication of heat exchangers. For the right design, materials and construction — for accuracy and efficiency — put your heat-transfer problems up to Aerofin.

AEROFIN is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

Highly skilled workers—continuous research—rigid specifications and tests—all combine to insure the efficiency and dependability of your Aerofin units.

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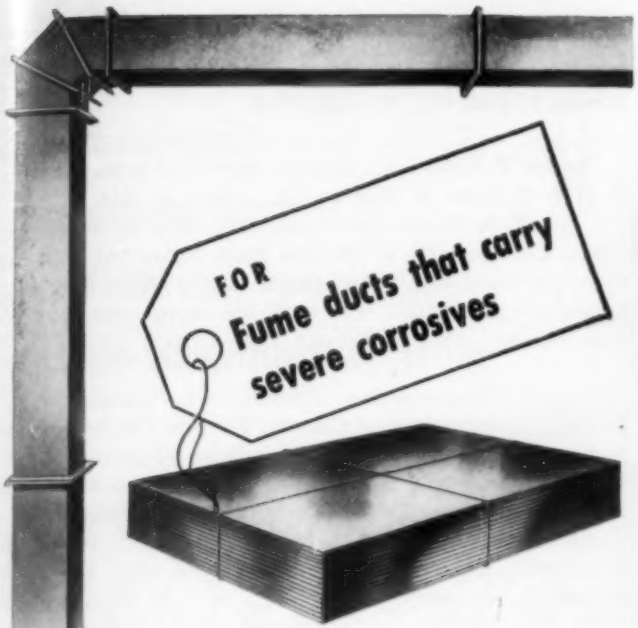

THE NEW DURIMET 20, ANTI-CORROSION SHEET AND PLATE

As Easy To Fabricate As Ordinary Stainless

To give the fume hoods and ducts in your chemical laboratory lasting corrosion-resistance make them of the new Durimet 20 sheet.

This newly developed form of Durimet 20 can withstand really tough corrosives. Its resistance is far better than ordinary stainless steels or even previous analyses of Durimet.

This corrosion resistance is as permanent, uniform and thick as the sheet itself. There is no lining to chip, crack or spall and leave the duct vulnerable. A Durimet 20 duct encloses laboratory fumes with a solid wall of corrosion-resistance.

This special stainless steel can be easily fabricated by methods familiar to ventilating contractors experienced in handling 18-8 stainless. It forms a light, strong, lasting fume passageway. Use it for laboratory table tops, sinks and troughs, too.

Write for Bulletin 502.

THE DURIRON CO., INC. • DAYTON 1, OHIO

Branch Offices In Principal Cities

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

ASCO SOLENOID VALVES

It's "Factory Mutual Approved," meaning that it has passed very rigid tests as to tight seating and reliability of operation!

This ASCO Safety Shut-off Valve is designed to protect personnel and apparatus heated by gas for it provides a sure automatic cut-off of the flow of gas to the burner should something go wrong necessitating instant shut-down. On failure of energizing current it closes instantly and remains closed until the current is restored *and* it is opened manually. The safety function is automatic; restoration to service is manual!

If you are operating or designing gas burners or gas-fired equipment, you will be interested in the full details of ASCO "Factory Mutual Approved" Safety Shut-off Solenoid Valves. Write us. If you are interested in other automatic flow control of gas or liquids, we have many other types of solenoid valves.

ASCO Solenoid Valves

When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

Automatic Switch Co.

389 LAKESIDE AVENUE • ORANGE, NEW JERSEY

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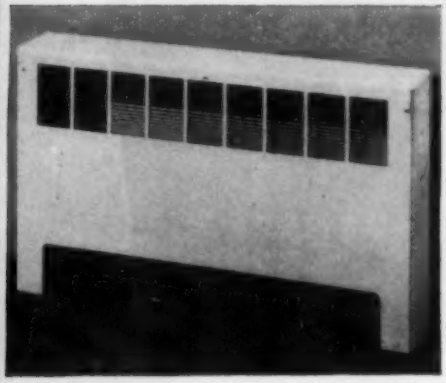

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America's Most Complete Line of CONVECTOR-RADIATORS

● NOW... Fedders offers you the *largest* selection of Convector-Radiators in America. Yes, there is an exact type and size for every kind of installation. Standardize on Fedders and you can be sure of a size and capacity to fit ANY job.

Write for complete catalog.

FEDDERS-QUIGAN CORPORATION

Dept. HP-H4, BUFFALO 7, N. Y.

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A Great Name Since 1896

Type RCB Type P Type PB

sales agency, is sales manager. Four new representatives are: Paul B. Huyette Co., Inc., Philadelphia; **H. R. Houghton Co.,** Baltimore; **W. B. Parsons Co.,** Boston; and **Gerald B. Duff Co.,** Newark, N. J.

Chester P. Gabosch has been appointed sales manager of **M & H Valve & Fittings Co.,** Anniston, Ala. .... **E. A. Bonneville** is managing sales of **Remington Corp.,** Cortland, N. Y. He has been connected with the merchandising of refrigeration, air conditioning, and appliances since 1925, and until his recent appointment, was vice president of Barcalo Mfg. Corp.

Western Furnaces, Inc., distributor in Tacoma, Wash., for heating equipment of **General Electric Co.,** has moved to a new, modern building located on Highway 99 between Tacoma and South Tacoma. The area served by the firm includes Grays, Lewis, Mason, Pacific, Pierce, and Thurston counties. Officers of the firm are **D. S. Robinson,** president; **H. J. Stelling,** treasurer; and **M. S. McDonell,** secretary. ..... A western New York sales division with headquarters in Rochester has been established by **Tinnerman Products, Inc.,** Cleveland. **Chris Ringhaver,** formerly in the Cincinnati district office, is in charge.

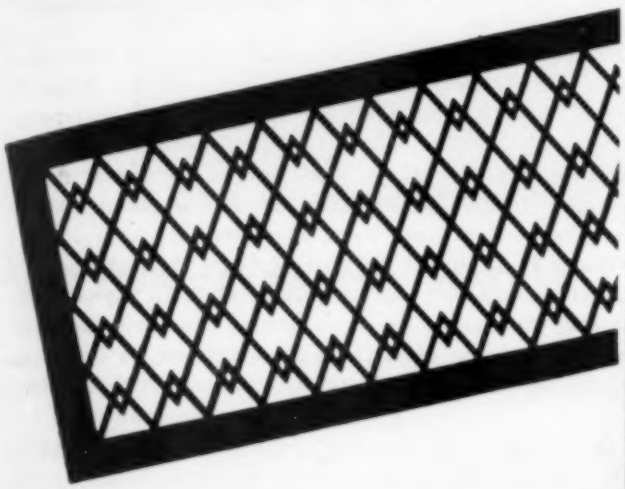
James Keith Louden, vice president and assistant to the president, York Corp., was presented with the Gilbreth Award at the recent annual banquet of the **Society for Advancement of Management.** The award was made in part for "his outstanding contributions to the advancement of the science of management, and specifically for the inception and organization of a comprehensive industrial engineering department in one of our large and progressive industries." ..... The **Thermal Insulation Society** has been organized with headquarters in Charleston, W. Va. According to its proposed constitution, it has been created to accumulate, record, and disseminate information and to advance the science of thermal insulation. Officers for the current year are: president—**Ray Thomas,** staff engineer, Carbide and Carbon Chemicals Corp.; vice president—**L. E. Langfitt,** assistant plant engineer, American Viscose Co.; treasurer—**H. B. Hickman,** engineer, E. I. du Pont de Nemours & Co.; secretary—**James Collins,** Johns-Manville Sales Corp.

Three new sales representatives have been appointed by **National Radiator Co.,** Johnstown, Pa. **A. C. Scates,** 311 Downing St., Jackson, Miss., is covering Mississippi, Louisiana, and southern Arkansas. **Howard J. Simpson,** 1734 S. Main St., Las Vegas, Nev., is handling Nevada, and **D. L. Bergman,** 231 Castlewood Ave., Dayton 5, is handling representation in the southwestern Ohio territory. ..... With offices at 3400 Forbes St., **William R. Robinson** is Pittsburgh district manager, power plant equipment division, **Swartwout Co.,** Cleveland. **James Hood Miller, Inc.,** Chamber of Commerce Bldg., continues to represent the industrial ventilation division in that city.

F. R. Fletcher is now in the Chicago district sales office of **Penn Electric Switch Co.,** Goshen, Ind. He was formerly a sales engineer in the Chicago district territory of White-Rodgers Electric Co. He now replaces **L. D.**

Hendrick Bulator

the dual-unit combination of a deflecting vane grille and an ornamental grille



Now you can secure in a single installation all the advantages of an adjustable vane grille—*to direct air flow*—and an ornamental grille—*to harmonize with the decorative scheme*—by specifying the new dual-unit Hendrick BULATOR. It is the first practicable combination that meets both the engineer's specifications for air throw and spread, and the decorative requirements of the architect.

In this dual-unit, the deflecting vanes are not noticeable, although they are mounted just behind the ornamental grille. The vanes are adjustable so that the air flow can be deflected to right or left, up or down, or in a combination of directions.

For the imposed ornamental grille section of the dual-unit Bulator, Hendrick offers a wide selection of attractive designs, with the open area essential.

Write for detailed information on the BULATOR

SEE OUR CATALOG IN SWEET'S

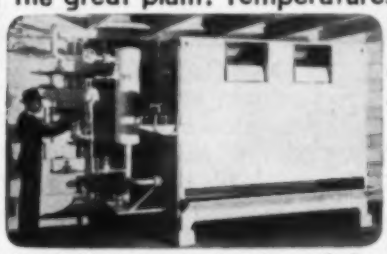
Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

HENDRICK
Manufacturing Company
48 DUNDAFF STREET, CARBONDALE, PA.
Sales Offices in Principal Cities

BIG NEW DAIRY PRODUCTS PLANT EQUIPPED WITH Frick Refrigeration

The M & R Dietetic Laboratories, Inc. will manufacture SIMILAC, the well-known baby formula, and TEN-B-LOW, a concentrate for making ice cream in the home, in their new plant at Sturgis, Michigan.

A complete Frick refrigerating system serves the great plant. Temperatures range from 10 deg. below zero to 40 above. Features of the cooling system are steam drive for two of the compressors, a booster compressor for low-temperature work, and two cold water tanks arranged for storing refrigeration by freezing ice on the pipe coils.



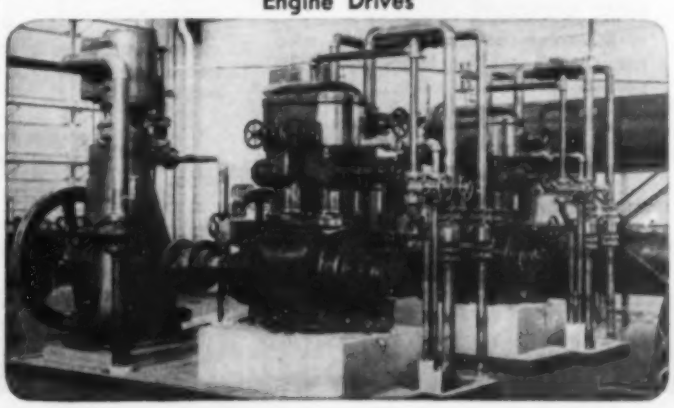
Frick Unit Cooler in One of the Freezer Storage Rooms

Cold Water Tanks, with Pumps and Ammonia Control Equipment

For that special cooling problem of yours, look to

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

Frick 11" by 10" Ammonia Compressors, with Steam Engine Drives



Linehan. The Penn Los Angeles district office has been moved to 228 Glendale Blvd. **E. M. Ford** is in charge. The Detroit district office, with **G. O. Sanders** as manager, is now located at 9551 Grand River Ave.

Richmond Radiator Co., New York, an affiliate of Reynolds Metals Co., has named **Harold D. McAneny** director of advertising. He was formerly an advertising agency account executive. ..... In a new and expanded sales and manufacturing program, **Belfield Valve Div., Minneapolis-Honeywell Regulator Co.,** Philadelphia, is adding to its field sales staff. Those assigned to full time work on regional valve sales are: **Russell A. Schlegel,** New York, in the eastern region; **George Brown,** Cleveland, in the central region; **Robert Scott,** Chicago, in the midwest and northwest regions; and **William Clements,** Los Angeles, in the Pacific, north coast, and mountain regions. All of these new appointees were formerly members of the field sales staff of Honeywell's Brown Instruments Division.

John Huber, who organized and operated for 20 years the Heil Automatic Heating Co. of Lancaster, Pa., has joined the home office sales department of the controls division, **Perfex Corp.,** Milwaukee. ..... **Peter T. Wotton** is now advertising and publicity director of **Typhoon Air Conditioning Co., Inc.,** Brooklyn, N. Y. **Edward L. Garfield,** secretary-treasurer, who has managed advertising and publicity in the past, retains executive supervisory control. Mr. Wotton has been with Benton & Bowles advertising agency for the last three years.

Unistrut Products Co., Chicago, has named **Spencer R. Griffiths** assistant sales manager. He was formerly in charge of stainless steel sales in the midwest district for Joseph T. Ryerson & Son, Inc. ..... **Wilson Frankland,** apprentice coordinator of Chicago pipe fitters since 1933, has resigned from this post. He has also resigned as business representative of Pipe Fitters Association, Local 597, and as secretary of the joint arbitration board of the Heating, Piping, and Air Conditioning Contractors Chicago Association and Local 597. He continues, however, as president of the local. **Joseph Phillips,** a member of Local 597 for 12 years, succeeds Mr. Frankland as apprentice coordinator.

Recent appointments in its sales organization have been made by **Yarnall-Waring Co.,** Philadelphia. **John A. Steer,** formerly Philadelphia district manager, is now in charge of the New York office, succeeding **Harold S. Webster** who has retired. **J. B. Ambler** is the new representative in the Denver district, and numerous steam trap distributors have been appointed. ..... **William F. Ryan,** for the past 12 years chief engineer of Salina Supply Co., has recently formed the **Ryan Engineering Co.,** Salina, Kans., consulting engineers specializing in the design of mechanical equipment for buildings. His brother, **James D. Ryan,** will be associated with him.

D. C. Goff is now director of the **Z-Crete Div., Zonolite Co.,** Chicago. He is the inventor of the division's system for insulating underground heating conduits and he succeeds **L. R. Reeder.**

Eventually...you will use

AMINCO DUNMORE

THE most sensational device ever introduced for measuring, indicating, recording and controlling relative humidity.

It has outmoded older types (such as those employing hair, animal tissue, bone, wood, plastics, etc.) by virtue of its amazing characteristics and performance. HERE'S WHY!

MOST SENSITIVE

Detects humidity changes as small as plus-minus 0.15% relative humidity.

SPEEDIEST IN RESPONSE

Responds instantly to micro changes in relative humidity at temperatures from 40° to 140° F. Response is slightly slower below 40° F., whereas other types are unresponsive.

MOST ACCURATE

Measures accurately within plus-minus 1½% relative humidity, without periodic attention.

OCCUPIES LESS SPACE

Sensing element occupies a maximum of two cubic inches.

MOST RELIABLE

Guaranteed for one year. Will give many more years of satisfactory service when used properly.

MOST VERSATILE

1. Can be used to measure, indicate, record and/or control relative humidity, also to drive air-operated devices.

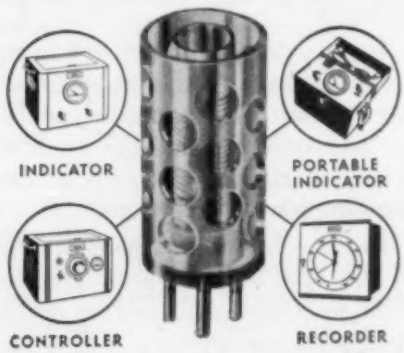
2. Can be used for remote control operation, since long connecting lines may be employed.

3. Since it does not add or remove moisture or heat, it can be built into hermetically-sealed electrical components.

4. The small size and weight of the sensing element enhances its adaptability.

5. Measures moisture content of solids as well as of air and other non-corrosive gases.

ELECTRIC HYGROMETER



This tiny element (illustrated actual size) is used in conjunction with one or more of the instruments shown in circles above for obtaining various combinations for measuring, recording, and controlling relative humidity.

PROMPT DELIVERY

Write for Bulletin 2164-F

AMERICAN INSTRUMENT COMPANY
Silver Spring, Maryland

Looking for a way to cut maintenance costs HERE?

—use Transite Industrial Vent Pipe

IF REPLACEMENT of venting equipment is running up your plant maintenance costs, Transite* Industrial Vent Pipe may help you save money.

In numerous installations, this Johns-Manville asbestos-cement product has demonstrated its ability to give long-term, economical service. Rustproof, it successfully resists many of the corrosive fumes, dusts, vapors and gases encountered in industrial venting operations. It requires no painting or other protective treatment—can be used for vents, ducts or stacks, in either indoor or outdoor service.

Transite Industrial Vent Pipe is available in a wide range of sizes (up to 36" diameter) with a complete line of Transite fittings that adapt it to practically any job requirement. It is light in weight and readily handled—can be cut and drilled on the job with ordinary tools. For additional information, write for Data Sheet, Series DS-336. Address Johns-Manville, Box 290, New York, N. Y.

*Transite is a Johns-Manville registered trade mark.

Typical Industries in which Transite Industrial Vent Pipe is used:

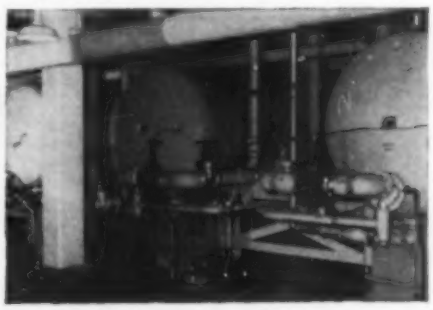
Aircraft	Foundry	Pulp & Paper
Automobile	Furnace	Quarrying
Baking	Furniture	Railroad
Bleaching	Gas	Rayon
Boiler Works	Glass	Refrigeration
Brewing	Laboratory	Rubber
Canning	Laundry	Shipbuilding
Ceramic	Leather	Shoe
Chemical	Match	Smelting
Dairy	Meat Packing	Soap
Drug	Metal	Soft Drink
Electrical	Mining	Sugar Refining
Explosives	Paint	Textile
Farm Machinery	Petroleum	Tool
Food	Potash	Water & Sewage

Johns-Manville TRANSITE Industrial Vent PIPE

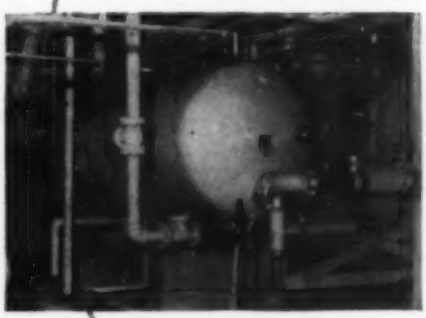
The SHAMROCK

America's Magnificent Hotel and Patterson-Kelley

Wyatt C. Hedrick, Architect & Engineer
Stone & Webster Engineering Corp., Construction Managers



Clean, uniform hot water for all guests on the eighteen floors comes from two of these 1400 gallon Patterson Type B Hot Water Storage Heaters. The third heater is the Booster for laundry hot water service.



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NEW BOOKS & REPORTS

New Text Is Outstanding Addition to Literature on Heat Transfer

Heat Transfer, Vol. 1, is the first of a proposed two-volume treatise by an international authority on heat transfer. Dr. Max Jakob, the author, is a graduate of the Royal Institute of Technology in Munich, who left Germany in 1937 to join the faculty of Illinois Institute of Technology where he is research professor of mechanical engineering. At Illinois Tech, he has taught courses in heat transfer at undergraduate and graduate levels and has acted as a consultant in heat transfer for the Armour Research Foundation. He is also nonresident research professor of heat transfer at Purdue University. The author has had nearly 50 years of experience in research and teaching.

This volume contains a very complete treatment of the fundamental laws of conduction of heat in the steady and unsteady state, convection without change of phase, heat transfer in evaporation, and heat transfer in condensation. Also, the basic equations of radiation are presented in an early chapter. The second volume, now in preparation, will contain additional material on radiation as well as a treatment of combinations of the several modes of heat transfer as they commonly occur in engineering apparatus. As might be expected, the book is sufficiently complete to make it invaluable to research workers in heat transfer and to teachers of this science. It is definitely not in the handbook style, however, and may well serve as a textbook for students of heat transfer at all levels of learning. This makes the book a unique and outstanding contribution—a welcome addition to the literature of heat transfer.

The air conditioning engineer would profit from a study of the treatment of heat conduction in the unsteady state. Transient state solutions and problems in periodic heat flow are fully covered. Many solutions of the partial differential equations are given without derivation. Along with these appear many special methods of great engineering significance. The mathematical meaning of conformal mapping is given. The theory of fictitious sources and images, largely due to Lord Kelvin and Lord Rayleigh, is presented as a means of finding temperature distribution in a medium limited by planes. There is an explanation of some of the basic principles of Heaviside's operational calculus, originally devised for treating problems in transient flow of electricity but equally valuable in transient-state flow of heat. The use of Laplace transforms, another operational procedure, is briefly explained. Numerical methods are presented, including the method of relaxation, developed by Southwell and others for analysis of continuous structures, but applied by Emmons and Dusinberre to the solution of problems in heat transfer. The equivalent graphical methods of Binder, Jakob, and Schmidt also appear. Some experimental analogues useful in solving heat conduction problems are explained, including the use of an electrolyte by Langmuir and others, as well as the permanent electrical networks exemplified by the Paschkis model at Columbia. One experimental method that is not explained is the use of laminar fluid flow and fluid storage as an analogy to heat conduction with storage—

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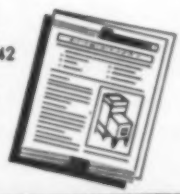

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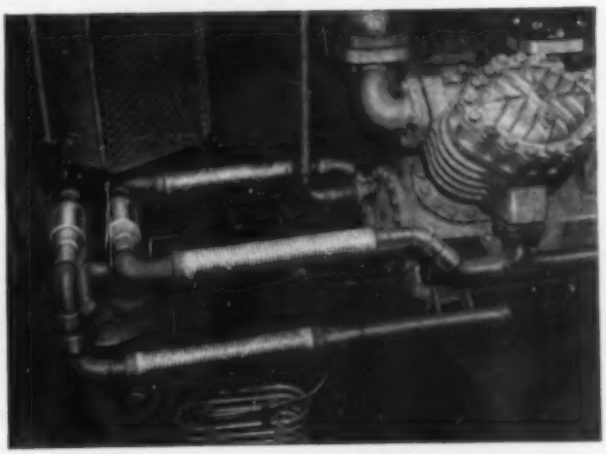

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an experimental analogue that has recently been applied to the solution of heat flow problems in air conditioning by Leopold.

Another topic in heat transfer and a subject of recent study, that receives full treatment, is the similarity between transfer of heat and transfer of momentum in the laminar layer, buffer zone, and turbulent core of a moving fluid. The contributions to this theory of Reynolds, Prandtl, Taylor, von Karman, Murphree, Boelter, Martinelli, and others are presented. Boundary layer theory and the general equations of velocity distribution based upon the experiments of Nikuradse are discussed.

It must be clear by this time that Dr. Jakob's book contains so complete a coverage of theoretical and experimental heat transfer that no short review can do it full justice.

Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, this 6 x 9 in. clothbound text contains 758 + xxix pages and is priced at $12.00.—Reviewed by C. O. Mackey, professor of heat-power engineering, Cornell University.

Covers Toxicology of Common Industrial Chemicals

Industrial Hygiene and Toxicology, Vol. 2, is the second of a two-volume treatise prepared by a group of specialists under the editorship of Frank A. Patty, director, industrial hygiene services, General Motors Corp. (Vol. I was reviewed in the May 1949 issue of HPAC.)

The text is made up of 20 chapters contributed by eight different authors. It is devoted almost wholly to the toxicology of various common industrial chemicals, and therefore is of less interest to most engineers in the heating, ventilating, and air conditioning fields than is the first volume. The scope of the work is indicated by the chapter titles which follow:

The Halogens, by Francis F. Heyroth, University of Cincinnati
Alkaline Materials, by Frank A. Patty, General Motors Corp.
Arsenic, Phosphorus, Selenium, Sulfur, and Tellurium, by Frank A. Patty
Compounds of Oxygen, Nitrogen and Carbon, by Frank A. Patty
The Cyanides and Cyanogen Compounds, by James H. Sterner, Eastman Kodak Co.
Industrial Lead Poisoning, by Robert A. Kehoe, University of Cincinnati
The Metals (Except Lead), by Francis F. Heyroth
The Aliphatic Hydrocarbons, by Frank A. Patty
Halogenated Hydrocarbons, by James H. Sterner
The Alcohols, by Joseph F. Treon, Jr., University of Cincinnati
Organic Acids, by James H. Sterner
The Esters, by James H. Sterner
The Aldehydes, by James H. Sterner
The Ketones, by Frank A. Patty
Ethers, Glycols, and Glycol Ethers, by Frank A. Patty
Aliphatic Nitro, Diazo, and Amino Compounds, by James H. Sterner
Nitro and Amino Compounds of the Aromatic Series, by Donald O. Hamblin, American Cyanamid Company
Phenol and Phenolic Compounds, by William B. Deichmann, Albany Medical College
Potential Exposures in Industry; Their Recognition and Control, by Frank A. Patty and Francis R. Holden, Naval Radiological Defense Laboratories.

It is apparent from the foregoing that the subject matter of this book is of value to all industrial hygiene personnel, especially the toxicologist and chemist. Other than the closing chapter, it contains little of direct value to the engineer.

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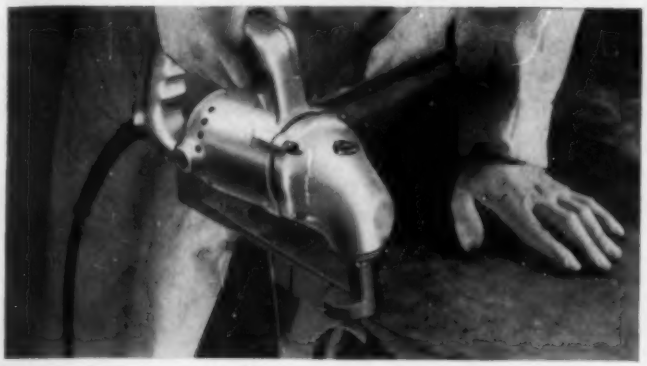

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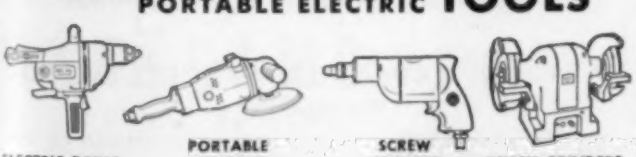

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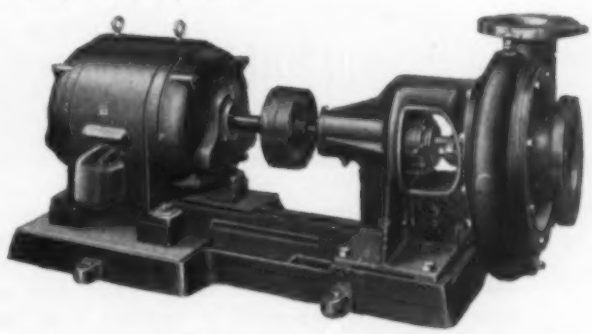

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science Publishers, Inc., 215 Fourth Ave., New York 3, for $15.00.—Reviewed by Allen D. Brandt, industrial hygiene engineer, Bethlehem Steel Co.

Stoker Performance Improved by Use of Ignition Baffles

The use of ignition baffles or refractory arches is one of the simplest and most effective means of improving the performance of single retort stokers, the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers were told at their recent joint 12th annual fuels conference. One of the outstanding advantages of these baffles is the fact that they may be used with either existing or new installations, it was declared. Also participating in the meeting was the Indiana Coal Preparation and Utilization Society.

Research with this equipment was conducted at the coal combustion laboratory, Pennsylvania State College, by T. S. Spicer, associate professor of fuel technology and supervisor of the laboratory, C. C. Wright, professor and head of the division of fuel technology, and R. J. Grace, assistant professor of fuel technology. They said the use of the baffle in one of the twin 178 hp fire tube boiler units for a dormitory heating plant during the 1948-49 heating season showed the following advantages: 1.) elimination of the black fuel bed over the retort, 2.) increase in the output of the stoker boiler unit by 40 to 50 percent, 3.) reduction of manual labor to a minimum, 4.) elimination of the periodic smoke discharge resulting from disturbing the bed, 5.) increase of combustion efficiency, 6.) increase of boiler efficiency by 4.0 percent although burning at higher rates, and 7.) fly ash and carryover to boiler tubes was less.

Other Books and Reports Received

Air Pollution in Donora, Pa.—Epidemiology of the Unusual Smog Episode of October 1948. Identified as Public Health Bulletin No. 306, this is a 173 page preliminary report issued by the Federal Security Agency, Public Health Service, Bureau of State Services, Division of Industrial Hygiene, Washington, D.C. It indicates that in addition to 20 deaths, the illness of 43 percent of the population was caused by smog over Donora and the nearby community of Webster for five days.

Manual of Accident Prevention in Construction—Third revised edition, published by the Associated General Contractors of America, Munsey Bldg., Washington 4, D.C., and priced at $3.00. This 264 page volume is a considerably expanded edition designed to make clear the safe way of performing construction work and to emphasize the costly results of incorrect, unsafe practices.

Pollen Slide Counts, by Grafton Tylor Brown, instructor in clinical medicine, Georgetown University School of Medicine; consultant on allergy, United States Public Health Service; and head, division on allergy, Doctors Hospital, Washington, D.C. Published by Charles C. Thomas, Springfield, Ill., and priced at $6.00. A reference book for allergists, technicians, and others interested in allergy. Contains drawings, photographs, and concise descriptions of hay fever pollen grains and larger fungus spores.

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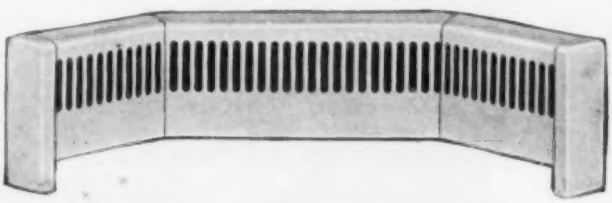

AUTO-RAD baseboard flexibility is best shown when following the contour of rooms and bay windows. Providing adaptability to floor layout which does not interfere with arrangements of furniture is an outstanding feature of Auto-Rad Radiators.

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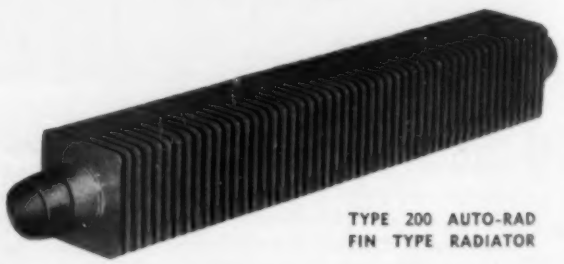

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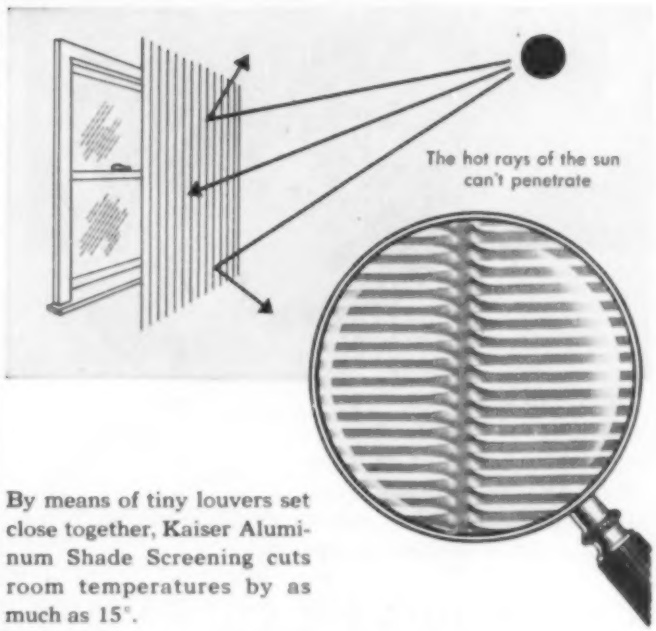

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MEETINGS & CONVENTIONS

National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland 14—The 36th annual convention, December 14 and 15, Hotel Cleveland, Cleveland.

American Meteorological Society, 5 Joy St., Boston 8—The 30th annual meeting, January 3 to 6, St. Louis. An air pollution symposium will be featured and papers and panel discussions to be presented include:

Climatology and Its Part in Pollution—"Normal" Atmospheric Contamination, by H. E. Landsberg, Research and Development Board

Enforcement Principles—Desirable Requirements and Standards, by J. H. Carter, Smoke Commissioner, City of St. Louis

General Effects of Air Pollution on Health—Allowable Conditions, etc., by G. D. Clayton, U. S. Public Health Service

Industrial Accomplishments—Available Equipment; General Approach to the Problem, by C. A. Gosline, E. I. du Pont de Nemours & Co., Inc.

Dispersion of Stack Gases in Stable Atmospheres, by M. L. Barad, New York University

Meteorological Instruments Useful in Air Pollution, by Dr. Michael Ference, Jr., Evans Signal Laboratory

Instruments for Air Pollution Measurement, by W. C. L. Hemeon, Industrial Hygiene Foundation of America, Inc.

Plant Maintenance Exposition and Conference, January 16 to 19, Cleveland Auditorium—Exhibits and conference subjects will deal with air conditioning, heating, ventilating, building supplies, electrical equipment, employee relations, instruments, lubricants, paints, materials handling, power generation and transmission, welding, etc. A group of 21 experts will take part in the discussions. The conference is sponsored by American Society of Mechanical Engineers and the Society for the Advancement of Management.

Advance registration cards may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, exposition manager. For hotel reservations, write to the Plant Maintenance Show Housing Bureau at the Cleveland Convention Bureau, Terminal Tower, Cleveland.

American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York 10—56th annual meeting, Adolphus and Baker hotels, Dallas, Tex., January 23 to 26. For additional information see the ASHVE Journal Section in this issue.

Southwest Air Conditioning Exposition of the International Heating & Ventilating Exposition—State Fair Grounds, Dallas, Tex., January 23 to 27. As in past years, the show will be managed by International Exposition Co., Grand Central Palace, New York City, and will be held under the auspices of the American Society of Heating and Ventilating Engineers which is represented by an advisory committee headed by A. E. Stacey, Jr., president of ASHVE. The show is expected to fill the Hall of Agriculture and the Poultry Building. For details see the ASHVE Journal Section in this issue.

American Society for Testing Materials, 1916 Race St., Philadelphia 3—Committee week and spring meeting, Hotel William Penn, Pittsburgh, February 27 to March 3.

The 53rd annual meeting and 9th Exhibit of Testing Apparatus and Related Equipment will be held June 26 to 30, Chalfonte-Haddon Hall, Atlantic City.

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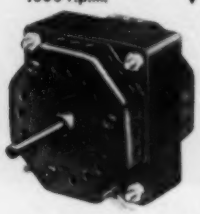
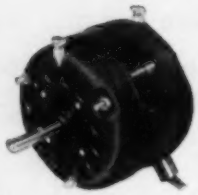
MODEL B
4-pole shaded pole motor. Approx. 1/30 h.p. 1550 r.p.m.

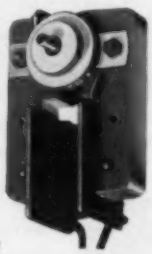




MODEL A
6-pole shaded pole motor. Approx. 1/30 h.p. 500 to 1050 r.p.m.

MODEL MS
2-pole shaded pole motor — full load h.p. .0021. Full load 2800 r.p.m.

Typical Fan Motor Uses
Air Circulators
Room Heaters
Exhaust Fans
Coolers
Air Conditioners
Unit Heaters
Hair Dryers
Controls



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National Association of Corrosion Engineers, 919 Milam Bldg., Houston 2—The 6th annual conference, St. Louis, April 4 to 7. Symposia under consideration include round table discussions on general corrosion problems and corrosion in connection with pipe lines, refrigeration and air conditioning, and the food industry.

Issues New Standards on Tubular Heat Exchangers

The original standards of the Tubular Exchanger Manufacturers Association was published in 1941. The new 1949 edition is a 94 page booklet just off the press.

According to the association, a group of 11 leading manufacturers of shell and tube exchangers, the standard is of value to anyone concerned with design, manufacture, specification, purchase, operation, or maintenance. Subjects covered include fabrication, performance, mechanical standards for petroleum refineries, commercial and general process applications, material specifications, fouling factors, temperature and temperature differences, heat transfer and pressure drop, thermal properties of fluids, and characteristics of tubing.

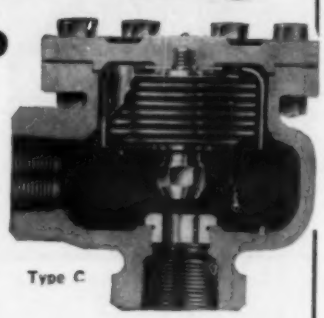
The new volume is the work of the association's technical committee under the chairmanship of Thomas H. Miley, manager, heat exchange dept., Foster Wheeler Corp. The editor is Townsend Tinker, chief engineer, Ross Heater & Mfg. Co., Div. of American Radiator & Standard Sanitary Corp.

Copies may be obtained from association headquarters, 53 Park Pl., New York 7. Paper covered copies are priced at $3.00, fabricoid covered copies at $4.00.

Nicholson Steam Traps

CUT Processing Time 30%

for Food Packer



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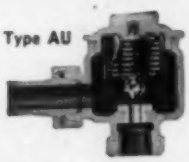
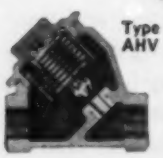


Type C

Type AHV



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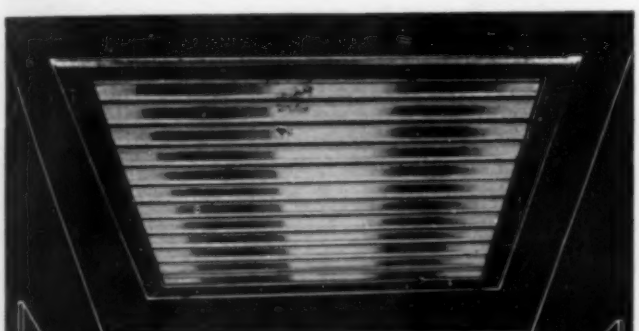

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HPAC 7496—AIR VALVES FOR CONTROLLING AIR CYLINDERS—Bellows Co., 222 W. Market St., Akron 9, Ohio, has issued Bulletin AV100 on its standard air valves for remote control of single and double acting air cylinders. In addition to the standard 4-way directional valves with built-in speed controls for mechanical or electrical operation of the company's air motors and air cylinders, a series of 2-, 3-, and 4-way valves for remote control of air cylinders or for incorporation in existing systems is offered.

HPAC 7497—BRONZE GATE VALVES—Fig. 20 and Fig. 30 standard bronze gate valves of Kennedy Valve Mfg. Co., Elmira, N. Y., are covered in Circular 102. Design features of the two valves are explained in detail, and service ratings, sizes, and dimensions are given.

HPAC 7498—CENTRIFUGAL PUMPS—Ratings, dimensions, and design and construction features of its double suction, single stage centrifugal pumps are given in Bulletin 955-N of Buffalo Pumps, Inc., Buffalo 5, N. Y. Both horizontal and vertical types are described. Capacities are from 10 to 10,000 gpm.

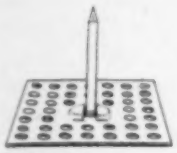
HPAC 7499—COMPRESSION DISTILLATION—A new four page folder prepared by Arthur D. Little, Inc., 30 Memorial Dr., Cambridge 42, Mass., describes the principles of compression distillation and outlines its present industrial applications. Distinctive features, advantages, and a brief history of its development are presented.

HPAC 7500—CORROSION RESISTANT MATERIALS AND EQUIPMENT—U. S. Stoneware Co., Akron 9, Ohio, has issued Bulletin M on its corrosion resistant tubing, gasketing, coatings, lining materials, grinding and mixing equipment, pipe and fittings, and tower packing. Materials and equipment are briefly described and illustrated.

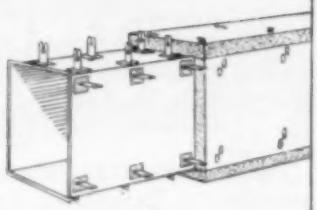
HPAC 7501—CORROSION RESISTANT PLUG VALVE—The type D "Durco" high silicon iron, lubricated plug valve is described in a new bulletin (No. 640) issued by Duriron Co., Inc., Dayton 1, Ohio. Features described include a new type lubricator, the "Teflon" diaphragm, and stainless steel packing glands.

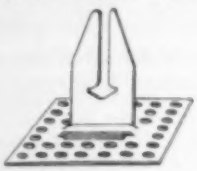
HPAC 7502—DEAERATORS—Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia 32, has revised its catalog on deaerators. The new publication (No. 3005) is said to combine the latest information on the importance of deaeration to feedwater chemistry with a complete description of the company's equipment.

Stic-Klips designed for application of all types of insulation on air ducts and apparatus casings.

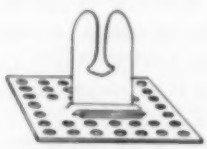


TYPE N — *For cork board, laminated indented asbestos boards and extra dense mineral wool boards.*





TYPE A
For light weight mineral wool boards and corrugated asbestos air cell sheets.



TYPE B
For dense mineral wool boards, and sound deadening materials

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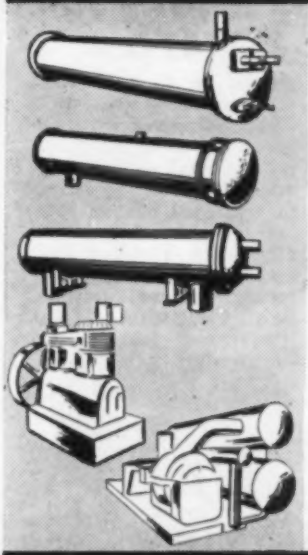

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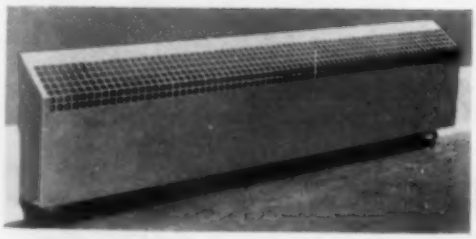

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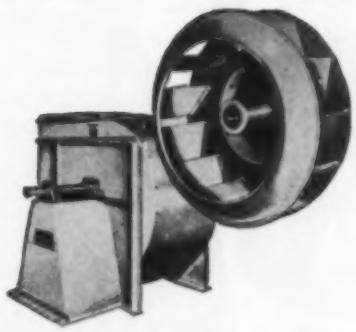

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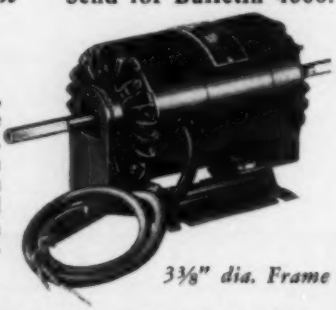

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HPAC 7503—FOOT SHEARS—Bulletin 80F-A of Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, covers the firm's new line of all-steel foot shears. Specifications are tabulated for three series of machines (short, medium, and long cutting length).

HPAC 7504—GAS AND LIQUID FILTERS—"Fulflo" filters, for clarifying a wide range of fluids and gases used in industry, are described and illustrated in Bulletin 1000 B-3 of Commercial Filters Corp., 18 W. 3rd St., Boston 27. Construction features, applications, capacities, and sizes are covered.

HPAC 7505—GAS BOILER—Catalog 557 of National Radiator Co., Johnstown, Pa., illustrates and describes the new series 55 gas fired boiler for steam, vapor, or hot water heating in apartments, hotels, stores, hospitals, schools, industrial structures, etc. Units are available in 32 sizes having AGA approved net ratings from 1195 to 9690 sq ft of steam radiation.

HPAC 7506—GAS FLOWMETER—A new variable area gas flowmeter, the "Floguide," has been developed by Fischer & Porter Co., Hatboro, Pa. The tapered metering tube and the "float" are fabricated from stainless steel. A data sheet, Publication 10070, gives capacities and dimensions.

HPAC 7507—IDENTIFICATION MARKERS—"E-Z Code" self-adhesive identification markers for wire, pipe, conduit, and cable are illustrated and described in a 12 page bulletin (No. 349) of Western Lithograph Co., 600 E. Second St., Los Angeles 54. Markers are available in a great many standard codes, including ASA and NEMA, or to individual specification.

HPAC 7508—LOW VELOCITY AIR DIFFUSERS—The Multi-Vent Div., Pyle-National Co., 1334 N. Kostner Ave., Chicago 51, has prepared Bulletin 395 on a recent application of its ceiling panels for low velocity air diffusion. A case history is used to explain the use of panels in large office areas, stores, restaurants, auditoriums, and small private offices. Also illustrated is the use of these diffusers behind perforated metal, acoustical ceilings.

HPAC 7509—MAGNETIC RELAYS—A new 12 page catalog (No. D-20A) issued by Ward Leonard Electric Co., Mount Vernon, N. Y., illustrates and describes seven standard types of magnetic relays for industrial and general purpose control applications. Data given include ratings, dimensions, coil specifications, and applications.

HPAC 7510—PAINT SPRAY UNIT—The "Graco Paintmaster" is designed to pump paint, enamel, lacquer, and other finishing materials from original containers to the spray head by a positive displacement, immersion type gear pump which is driven by an air motor. No air pressure is exerted upon the paint itself and an agitator at the base of the pump is used to keep the paint mixed. The unit is covered in a new eight page bulletin released by Gray Co., Inc., 61 11th Ave., N.E., Minneapolis 13.

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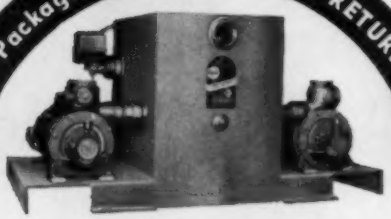

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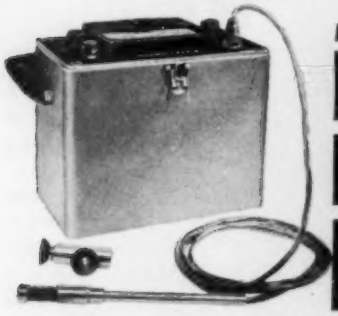

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HPAC 7511—PIPING SPECIALTIES FOR REFINERIES—A new 20 page catalog of Black, Sivalls & Bryson, Inc., 720 Delaware, Kansas City 6, Mo., is devoted to the company's refinery products. Information is included on safety heads, relief valves, vent valve and flame arrestor combinations, fuel vaporizers, storage tanks, chemical feeders, pipe half soles, heaters, separators, gas scrubbers, and dehydrators.

HPAC 7512—RAW SEWAGE PUMPS—Bulletin 964-E of Buffalo Pumps, Inc., Buffalo 5, N. Y., covers the company's line of nonclogging sewage pumps. Equipment described includes pumps for sewage lift stations, sewage treatment plants, sludge circulation or agitation, and sludge removal. The line includes vertical and horizontal solid shell models, horizontal diagonally-split shell pumps, and self priming horizontal pumps.

HPAC 7513—RECESSING CONVECTORS—Booklet 1865, prepared by The Trane Co., La Crosse, Wis., explains how to recess the firm's type A convectors. A series of photographs is presented in a step-by-step sequence as plaster, woodwork, finished flooring, and draperies are added to the room and as the convector installation progresses.

HPAC 7514—REFRIGERATION PARTS AND SUPPLIES—Catalog 15 of Wagner Tool and Supply Corp., 1308 43rd Ave., Long Island City, N. Y., covers the "Watsco" line of tools, parts, and supplies for the refrigeration service man.

HPAC 7515—RESEARCH FACILITIES FOR STRESS ANALYSIS—Experimental and analytical stress analysis is one phase of applied mechanics and mechanical engineering research at Armour Research Foundation of Illinois Institute of Technology, Technology Center, Chicago 16. Research facilities and stress analysis methods are described and illustrated in a new booklet.

HPAC 7516—RIVETS, NUTS, FASTENERS—South Chester Corp., Finance Bldg., Philadelphia 2, has issued a 28 page manual giving design and construction features, dimensions, and applications of its "Southco" blind rivets, anchor nuts, panel fasteners, door retaining springs, etc.

HPAC 7517—ROOM TYPE AIR CONDITIONING UNITS—Remington Air Conditioning Div., Remington Corp., Cortland, N. Y., has prepared a 12 page booklet which emphasizes seven functions of air conditioning and stresses the importance of year 'round conditioning. The company's line of room type conditioners is briefly described and illustrated.

HPAC 7518—SEAMLESS CARBON STEEL PIPE—Babcock & Wilcox Tube Co., Beaver Falls, Pa., has issued price sheets for plain and random length, seamless carbon steel merchant pipe. The new price sheets cover both grade A and grade B in sizes 1½ in. and under and in standard, extra heavy, and double extra heavy weight.

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BIGGEST STEAM TRAP NEWS in 50 years!

Clark DUO-STEP Leverage

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Hand-Powered "American" A-30

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RADIANT HEAT BENDS in Standard Pipe

Fast . . . Accurate . . . Average bend takes only 60 seconds! Up to 180° bends . . . all sizes from ½" to 2". Usual radiant heat bends for 1¼" at 6" and 9" radii can be supplied. Only 7 parts. Occupies 18" x 18" floor space.

Capacity ½" to 2" standard pipe . . . Minimum radius 5 times pipe diameter up to 180° . . . Maximum radius 13". Complete with rolls for each size pipe. Standard motor equipment 2 h.p.

Special radii supplied on request.

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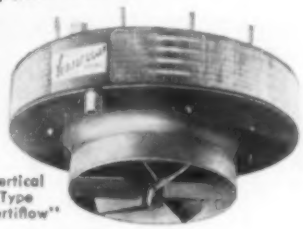
● Horizontal discharge and adjustable louvers provide a variety of heat direction angles for eliminating "cold spots." Available in 14 sizes for steam or hot water systems.

● Particularly adept at delivering heat from high levels. Unique "ventilating" method prevents motor baking. Made in 7 sizes with 3 types of diffusers for regulating heat patterns.



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Cabinet Type

● Adds attractive cabinet styling to unit heater performance. Quiet operating. Available in 3 sizes in each of 3 cabinet styles to meet all requirements.

For full details on one or more of these Unit Heater types write for free catalogs.

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Mercoid brand switches are noted for their superior operating qualities. Various types available.

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Available for gasoline, oil, ammonia or other low specific gravity liquids. Also for liquids at high pressures.

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Used for maintaining fluid levels in tanks or for control of sump pumps, etc. Two types, the counter-balance type and plunger type available.

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Many designs for all purposes—air conditioning, ventilating, radiator enclosure and concealment. Almost any sizes in steel, aluminum, brass or bronze. In selecting grilles, you will find Auer Grille Catalog "G" useful. It gives complete grille data, shows all Auer designs, with dimensions, opening sizes, and full scale details. Sent on request. Order Auer Grilles by name and number.

THE AUER REGISTER COMPANY
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Also covered in new price sheets are boiler tubes; cold drawn in sizes 1 in. and 1¼ in. OD, and hot finished in sizes 1½ in. through 6 in. OD.

HPAC 7519—STEAM HUMIDIFIERS—Armstrong Machine Works, Three Rivers, Mich., has issued revised Bulletin 1772 covering its complete line of steam humidifiers, including two new air controlled models. The 12 page bulletin contains a discussion of dry air problems, tables on desirable relative humidities and regain of hygroscopic materials, and data on the operation and installation of the company's units, both electric and air controlled models. Also listed are air operated and solenoid valves manufactured by the firm for use in humidifier control.

HPAC 7520—STEEL BOILERS—Two new catalogs have been issued by Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York 17. The series 80 steel boiler, oil or gas fired, for 1100 to 3000 sq ft of steam, is described in a four page folder. The "R-Z-U Junior" steel boiler, also in sizes from 1100 to 3000 sq ft of steam for all fuels, is covered in another folder. Both booklets give data on design and construction, dimensions, SBI net ratings, etc.

HPAC 7521—THREADING STAINLESS STEEL—An article by J. J. Robert, assistant general manager, stainless engineering and machine works, Cooper Alloy Foundry Co., Hillside, N. J., tells how properly trained personnel, using carefully selected equipment, can thread and tap stainless steel at high production rates and achieve uniformly high quality. Reprint copies are available from the company.

HPAC 7522—TUBE EXPANDERS—Bulletin 380 of Thomas C. Wilson Inc., 21-11 44th Ave., Long Island City 1, N. Y., covers "Wilson-Dudgeon" expanders for high pressure boiler tubes, superheaters, economizers, water walls, circulating tubes, etc. in stationary and marine steam generators. Various models of tube cleaners are also illustrated.

HPAC 7523—TURNING VANE AND AIR VOLUME CONTROL—Anemostat Corp. of America, 10 E. 39th St., New York City, has developed the "Turnotrol", a turning vane and volume control device for balancing heating, ventilating, and air conditioning systems. Bulletin 30 tells how the device is used with ceiling air diffusers and how it is designed provide uniform flow, small friction loss.

HPAC 7524—UNIT VENTILATOR—Bulletin S-340 of The Trane Co., La Crosse, Wis., covers the company's unit ventilator and its uses in school rooms. Color illustrations show this heating and ventilating unit in typical school rooms and its advantages are pointed out.

HPAC 7525—VIBRATION ISOLATORS—Containing specification charts to simplify selection, a new 24 page catalog has been released by Finn & Co., 2850 Eighth Ave., New York 30, on its complete line of vibration isolators. Also included is a discussion of the theory of vibration isolation and shock.

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INDUSTRIAL
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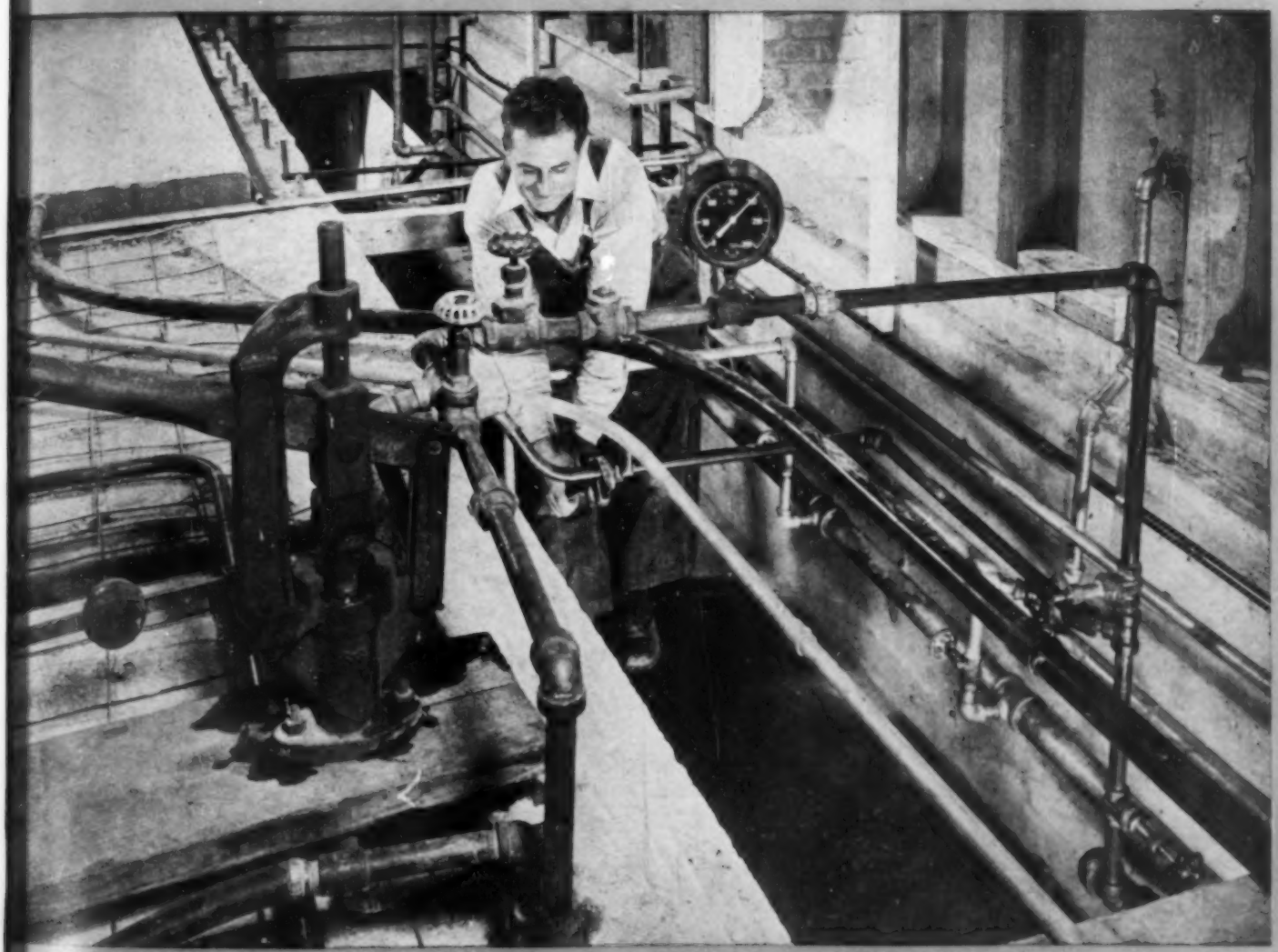
PUBLIC BUILDINGS

Page 99—Journal Section of the American Society of Heating and Ventilating Engineers



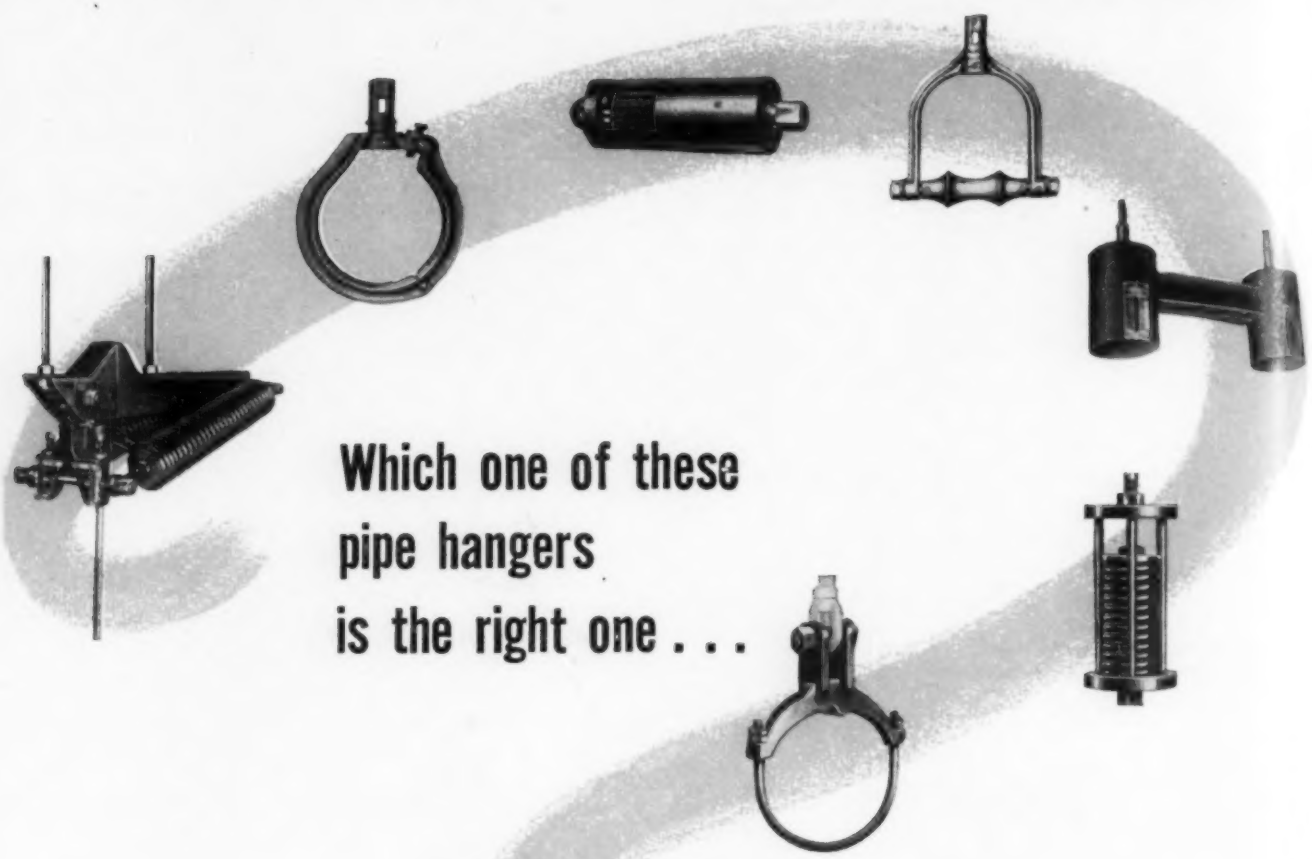
Testing heating system for modern school—page 82

The Myth of the Indoor Sun 74

Keeps Water in Conditioning System During Winter....77

Why Rated Hot Water Relief Valves? 96

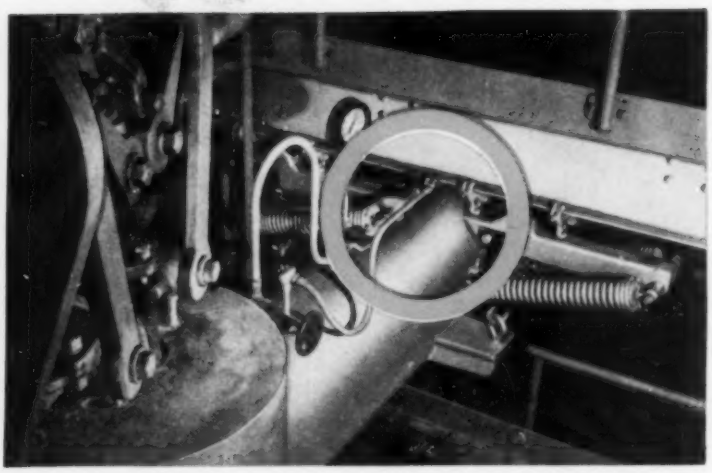
Complete Contents of This Issue 5



Which one of these pipe hangers is the right one . . .

for this spot?

THIS BIG BOILER LEAD from a superheater outlet at the stop and check valve in a power station presents a critical problem in pipe suspension. From its position when cold to its position at 900°F., this piping travels through all three planes — vertical, lateral and longitudinal. That would set up dangerous stresses and strains if its great weight were not fully supported at every point of its travel by Grinnell Constant-Support Hangers. Your piping problems may be much less complicated but, whatever the problem, Grinnell offers you a complete service . . . Grinnell piping supplies, Grinnell engineering, Grinnell warehouse service, and Grinnell jobbers in practically every city and town.



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Sales notes from usAIRco Dealers . . .

MODU-AIRE

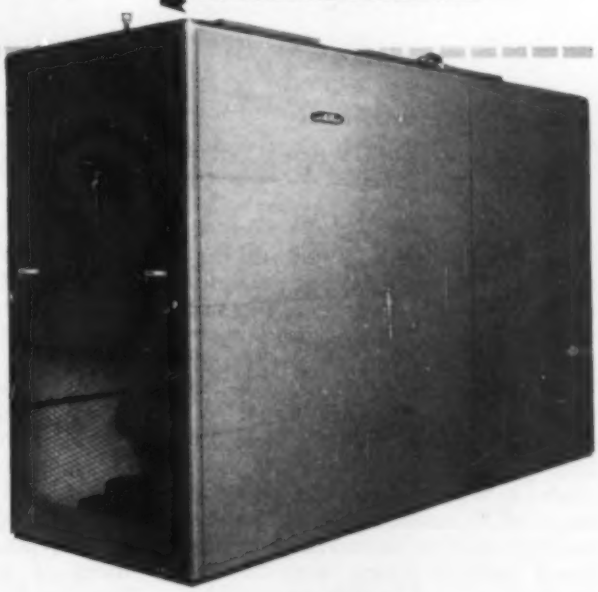
HOTEL SALES PROBLEM

Client had long wanted to air condition 115 of his higher priced rooms, but feared cost of building alterations. He was sure ductwork would lower ceilings too much and occupy rentable floor space. Also, he didn't like the idea of having those high premium rooms closed to guests all the time installation was going on. He told us not to bother him unless we could solve all his problems at once.

usAIRco SOLUTION

We told him immediately about usAIRco Modu-aire. We explained how this low cost multi-unit system is installed without space-wasting ductwork . . . how easily the necessary plumbing is installed without interfering with room rentals for more than a day or so . . . how each Modu-aire unit is equipped with coil for both cooling and heating . . . and how each room occupant may select his own temperature . . . how Refrigerated Kooler-aire Model C furnishes abundant chilled water for Modu-aire installations. We gave him his choice of the Modu-aire recessed unit or the free-standing model. In other words we solved all his air conditioning problems at once . . . with Modu-aire. He signed the order.

REFRIGERATED KOOLER-AIRE



SUPER MARKET SALES PROBLEM

Proprietor has wanted air conditioning for a long time but kept running into bothersome problems. City wouldn't give him a permit to sink a well due to water shortage. Superintendent of building claimed roof wouldn't support a tower without costly structural changes. Very limited space available to install plant. Said he was losing money not having air conditioning but didn't see how he could overcome these factors.

usAIRco SOLUTION

We told him he didn't need a well . . . didn't need a roof tower . . . didn't need any more space than he had to install a usAIRco Refrigerated Kooler-aire. We explained that Refrigerated Kooler-aire is the automatic "central plant" unit that's compacted into a single small cabinet. We showed him how its built-in evaporative condenser saves up to 95% on water consumption . . . without a roof tower. We pointed out to him that Refrigerated Kooler-aire moves in through average size doors so walls needn't be ripped out . . . how it's installed with only three simple connections. We took him to inspect other RK installations we'd made in town. We finished his RK installation last week.

Your Sales Problem

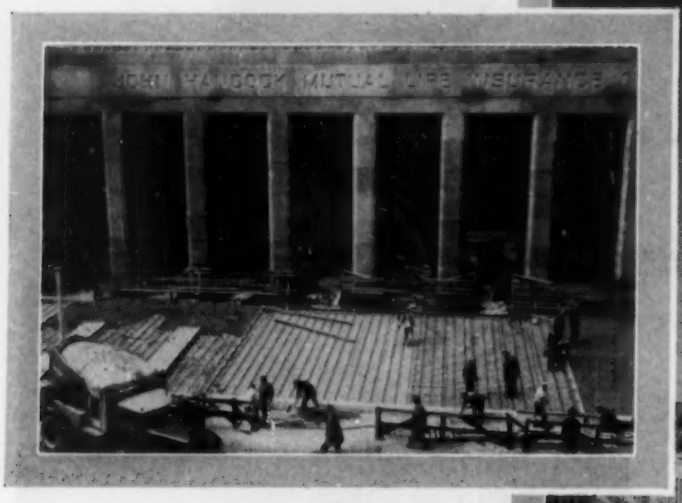
may be different from either of these . . . but whatever it is that's keeping your prospect from buying air conditioning equipment, the chances are you'll find a usAIRco unit to turn every one of his objections into a strong, positive selling point. Next time you find yourself wrestling with a reluctant prospect, let us know. We're usually able to help you get the order.

usAIRco

UNITED STATES AIR CONDITIONING CORPORATION • Como Ave. S. E. at 33rd Minneapolis 14, Minn.

HEATING, PIPING & AIR CONDITIONING, published monthly by Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill., U.S.A. Yearly subscription rates U.S. and Possessions, $3.00; Canada, Cuba, Mexico, Central and South America, $4.00. Other countries, $6.00. Current copies U.S. and Possessions, 35 cents. Back numbers, 60 cents. January 1949 issue, $1.50 per copy. December, 1949, Vol. 21, No. 12. Entered as Second Class Matter May 18, 1929, at the Post Office at Chicago, Ill., U.S.A., under the Act of March 3, 1879. Additional entry at Milwaukee, Wis.

JOHN HANCOCK MUTUAL LIFE INSURANCE CO.
BOSTON, MASS.
CRAM AND FERGUSON, Architects & Engineers
TURNER CONSTRUCTION CO., Builders
JOHN F. McCARRON, Inc., Plumbing Engineer
M. AHERN CO., Plumbing Contractors
BUERKEL and COMPANY, Inc., Htg. Engineers & Cont.



. . . snow melting
. . . radiant heating
. . . 8 other plumbing and heating services

ALL BYERS WROUGHT IRON PIPE

In addition to its architectural distinction, this new building is notable for its snow melting system, which is thought to be the largest ever installed.

The sidewalks on three sides of the structure, an area 20 feet x 720 feet, have grids of Byers Wrought Iron pipe embedded in the concrete, to keep the walkways free of snow, slush and ice. A similar snow melting system is installed in the truck loading space, and radiant heating is used in the main lobby and the theatre lobby. Both of these systems utilize Byers Wrought Iron pipe, and the material is also applied in a number of building services: drainage, waste, vent, fire and soap lines; downspouts; concealed steam supply lines; and all steam return lines.

The wisdom and soundness of these specifications are abundantly confirmed by engineering records. Surveys of the life of wrought iron in identical or parallel services have shown many instances of wrought iron pipe still serving after periods of 30—40 and even 50 years, in areas where ordinary materials required repair or replacement in a fraction of that time.

It is natural that wrought iron should offer something unusual in service properties, for its composition and structure are unique. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and disperse corrosive attack. This discourages the pitting and rapid penetration that causes vulnerable materials to fail prematurely. The fibers also help to anchor the initial protective scale, which shields the underlying metal.

The best guide in applying wrought iron is not a list of current uses, but a knowledge of its manufacture and characteristics. The story is condensed in our booklet, THE A B C's of WROUGHT IRON. We will be glad to send you a copy on request.

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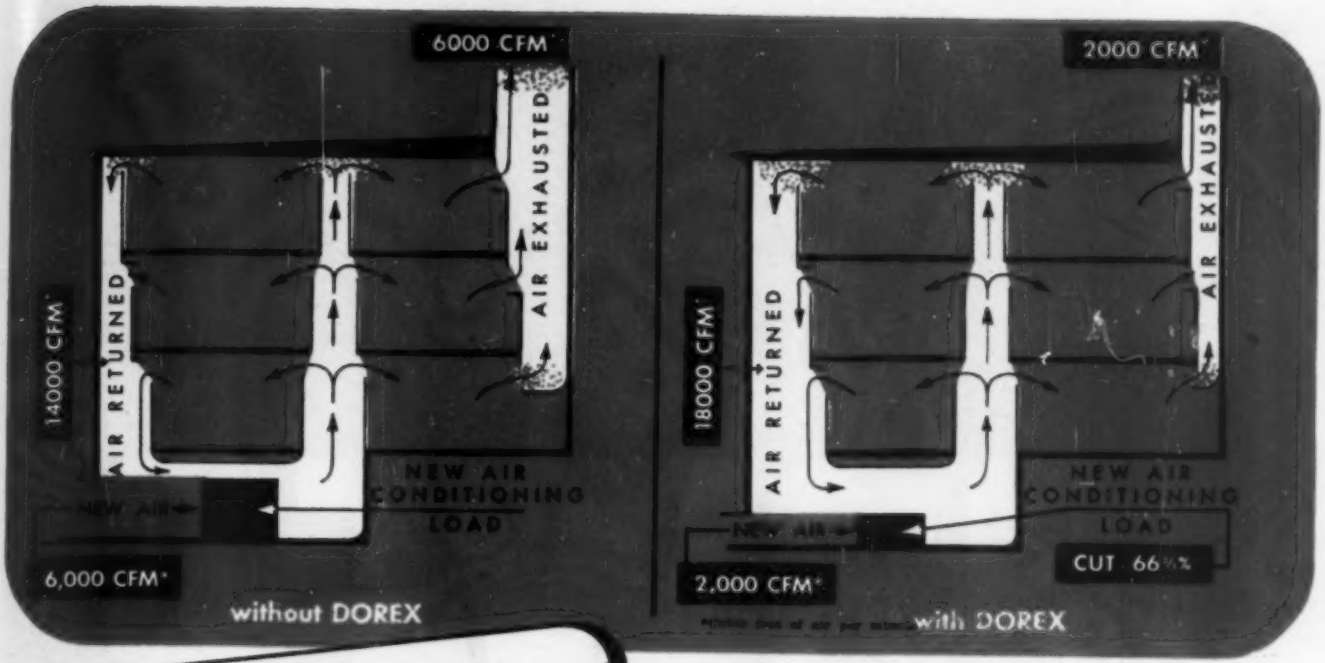
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



How Much Money can Dorex Air Recovery save?

Briefly, here's the answer: Every 1,000 cubic feet of conditioned air that is exhausted per minute costs over $200.00 a year. If, for instance, you are exhausting 6,000 CFM, you are, in effect, throwing out $1,200.00 worth of conditioned air.

Suppose Dorex could cut that only in half. That would mean $600.00 worth of conditioned air saved. But Dorex has been able to cut air conditioning exhaust—and the unconditioned outdoor air needed to replace it—*as much as* 75% in many cases.

Dorex changes *used* indoor air back to its original outdoor freshness by removing the odorous gases that make the air stale, stuffy and unpleasant. With Dorex, you can recirculate more of the indoor air you have already heated or cooled, cut down your outside air intake and reduce your equipment and operating cost.

Net saving for each 1000 CFM recovered averages $240.00

Based on year-round conditioning system in average temperate zone.

Cost to condition 1000 CFM outdoor air per annum

Refrigeration Machinery (3 tons @ $250.00)	$750.00	
Heating Equipment (100,000 BTU @ .0025)	250.00	
15% Interest and Amortization on $1,000.00		$150.00
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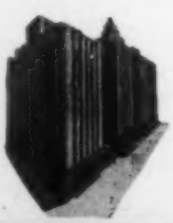
Oil (Average 0.47 gals. x 2600 x .08)		98.00
Water plus pumping cost (based on Cooling Tower)		10.00
		$294.00

Cost to recover 1000 CFM recirculated air per annum

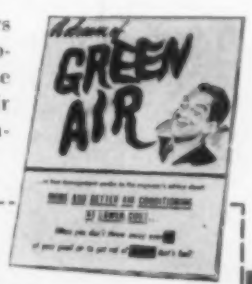
DOREX Air Recovery Equipment installed	$160.00	
15% Interest and Amortization on $160.00		$ 24.00
Carbon Reactivation Cost (once per year)		30.00
		$ 54.00

Net annual savings per 1000 CFM $240.00



The Criminal Courts Building in New York saves money with Dorex. This famous building is just another one of the 5,000 Dorex installations furnishing more and better air conditioning at lower cost.

Engineers, contractors and dealers who have this book say it's a helpful "sales tool" in convincing those who are reluctant to invest in air conditioning in these "cost-conscious" days.



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POWER: "force or energy applied or applicable to work"—Webster

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● ● ● 1,775,000 pounds of super-heated steam per hour! That's the turnout of the two newest boilers of the Huntley Station's 60-cycle plant, Buffalo Niagara Electric Corp., part of the Niagara Hudson Power System. The "Buffalo" Fans shown here supply the primary and part of the secondary air to these boilers — the never-ending Air of Power on which so much depends.

Truly here, as in any boiler room, the "cheapest" draft fan is the one that runs the longest without expensive timeouts! And "Buffalo" engineers have built these fans accordingly — EXTRA HEAVY in every part where continual heat, erosion or general wear could occur. Such construction has paid for itself many times over in the thousands of "Buffalo" Draft Fans in industry.

For your Air of Power, Air of Efficiency or Air of Comfort, call on "Buffalo" for the specialized fan or air conditioning unit to deliver it cheaper and longer. Over 70 years of "Air Know-How" back your choice.

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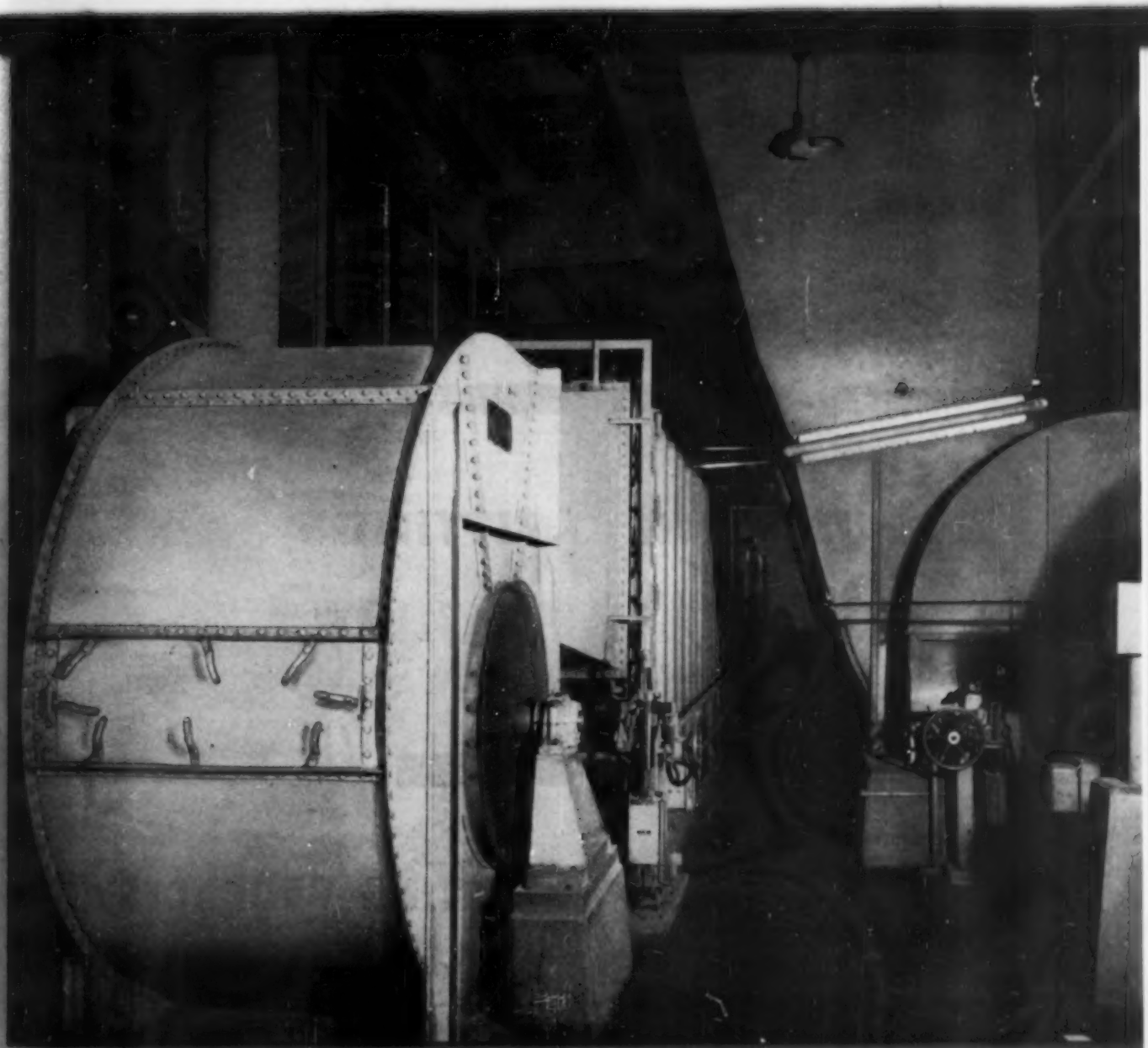

"Buffalo" Forced and Induced Draft Fans Doing Industry's Severest Air Job 'Round-The-Clock At Huntley Station

24 hours a day, these "Buffalo" Primary Air Fans blast pulverized coal and air to Huntley Station Boilers

From

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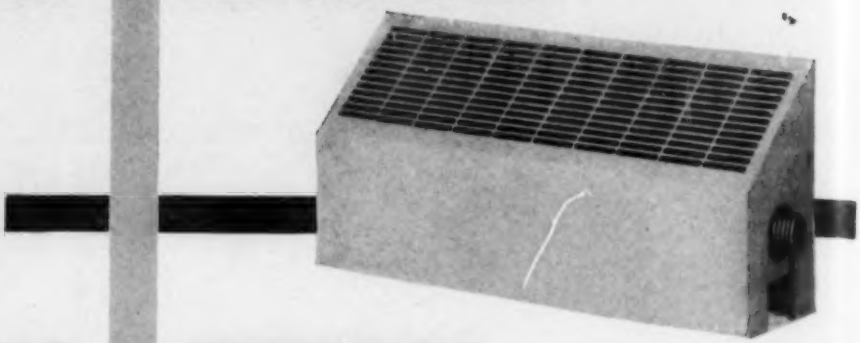

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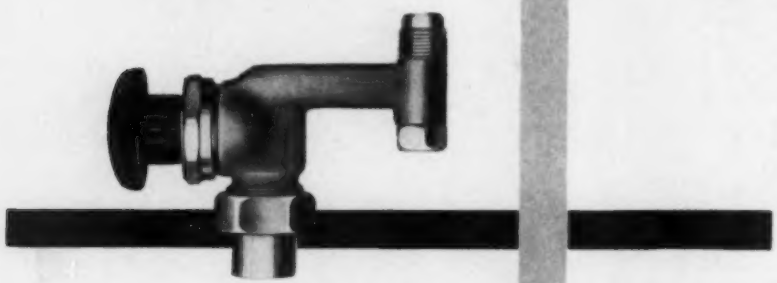

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Increase customer satisfaction *and* your profit

Dunham Fin-Vector Radiation is a case in point. These long, narrow, finned pipe heating elements are ideal for many installations where standard radiators are not suitable. They are light in weight but of unusual strength and heating capacity and are available with attractive covers.

Unique Dunham design enables the fins to be interlocked when pressed on to the pipe. This tight mechanical joint provides a permanent and greater contact area between fins and pipe . . . eliminates use of solder bond without sacrifice of heat transfer. Single pipe feature permits high, safe working pressures . . . absorption of sudden shock without injury.

Products Like These Help Dunham Vari-Vac* Heating Cut Fuel Costs Up to 40%

It's quality products like these that enable Dunham Vari-Vac Differential Heating to effect sensational fuel savings in Spokane's Davenport Hotel, the Rochester General Hospital and other well-known buildings all over the country.

So, whether your customer needs a simple regulating fitting, finned pipe radiation . . . or a complete system to heat his entire building . . . it will pay you to investigate the broad line of Dunham Heating Products.

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Write today for your free copy of Bulletin 634-B, containing complete information on all Dunham Heating Specialties, Unit Heaters, Pumps, Cabinet and Baseboard Radiation.

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put this pump in your line!

FAIRBANKS-MORSE
Hot Water Circulating Pump

10 reasons why YOU will like it!

1. Steady, year-round market.
2. Easily installed—vertically, horizontally.
3. Broad appeal—many prospects.
4. Good will builder.
5. Helps find prospects for new boilers.
6. Priced attractively—profitably.
7. Reduces number of free service calls.
8. Four sizes—to meet any normal installation.
9. Replacement parts immediately available.
10. Made by Fairbanks-Morse.

10 reasons why YOUR CUSTOMERS will like it!

1. Heats *all* radiators—keeps them *hot*.
2. Maintains even temperature in *all* rooms.
3. Smooth, quiet operation.
4. Saves on fuel.
5. Rarely needs oiling.
6. Lightweight.
7. Quickly installed any time.
8. Durably made.
9. Leakproof.
10. Guaranteed by Fairbanks-Morse against defects in materials and workmanship.

MAIL COUPON FOR PRICES—FACTS!

FAIRBANKS-MORSE,

a name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS
GENERATORS • STOKERS • RAILROAD MOTOR CARS and STANDPIPES
FARM EQUIPMENT • MAGNETOS

Fairbanks, Morse & Co.,
600 S. Michigan Ave., Chicago 5, Ill.

Gentlemen:

We want to know all about your circulating pump for hot water heating systems. Have your representative call.

Company name .....

Address .....

City..... Zone..... State.....

NO PROJECT TOO LARGE —

APARTMENTS

OR TOO SMALL

FOR SARCOTHERM

HOMES

Because large conventional hot water projects and deluxe radiant heating jobs have given Sarcotherm more than ordinary publicity lately, is no reason to overlook stores, offices, factories and individual homes.

For Sarcotherm is the delight of any heating man who is in competition, either as to the over-all price of the heating job or the luxurious comfort and convenience that various hook-ups with Sarcotherm can provide.

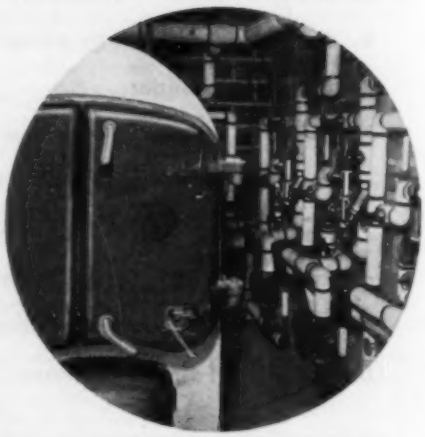
FACTORIES

Control by the Weather

Sarcotherm is a simple mixing valve, actuated by two liquid filled thermostats, inside and outside the building. Warm return water is mixed with hot boiler water, and delivered at the temperature needed at that particular hour. It is all mechanical—no electricity, or compressed air. No mysteries to explain to the owner.

And Sarcotherm is extremely flexible. Multiple zone control, split systems, automatic set-backs and double switch lines can be incorporated with ease.

THE NEW SARCOTHERM CATALOG and TECHNICAL BULLETINS ARE AVAILABLE FOR YOUR FILES



Three Sarcotherms on zone control in motel.

16

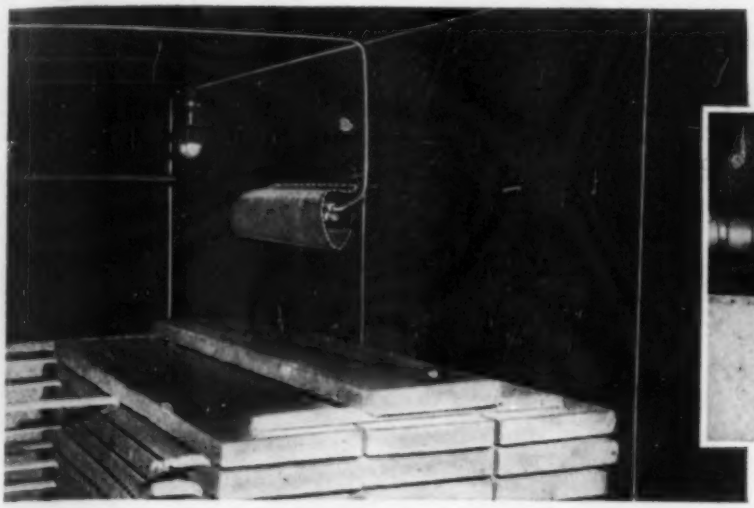
Sarcotherm

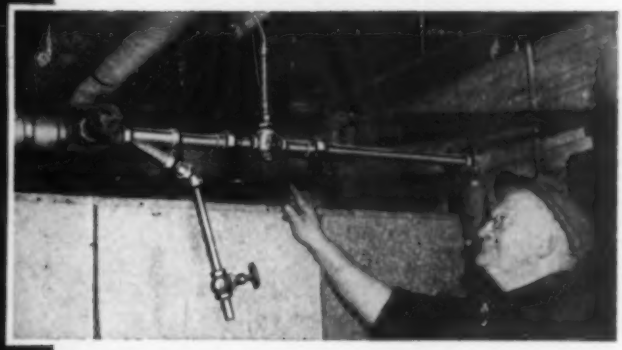
SARCOTHERM CONTROLS, INC. • Empire State Bldg. • NEW YORK 1, N. Y.

Is a penny a day too much

FOR PERFECT KILN, OVEN OR ROOM CONTROL

1¢





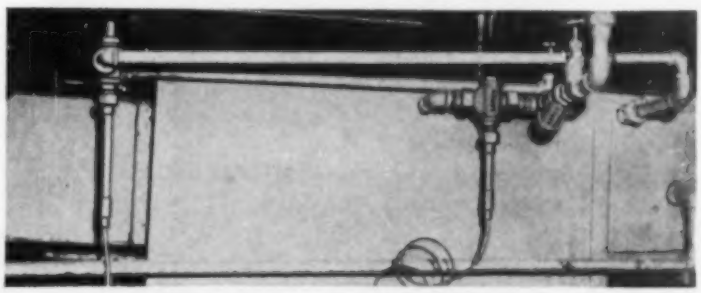
Mr. H. Klank, the maintenance engineer of the American Laundry Machine Company plant in Chicago says that this Sarco KR-14 Room Control has been on this wood kiln for 27 years without repairs. He ought to know, because he put it on there.

Recent reports include a Sarco Control in California overhauled after 24 years service and one in Cleveland in 25 years without repair and the owner figures that temperature control has cost him less than a cent a day.

OFFICE ROOM CONTROL

W. H. Barber, manufacturer of lubricating oils in Chicago, experienced difficulty with the office heating until the Sarco KR-14 room control with Sarco Float-Thermostatic Steam Traps were in stalled. Now "no trouble and don't expect any."

HEAT AND HUMIDITY CONTROLS



In baking, if it's not the heat—it's the humidity. This plant makes identical loaves of top quality bread day in and out because both heat and humidity of proof boxes are Sarco controlled.

LET THE SARCO ENGINEER NEAR YOU SUGGEST

274

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

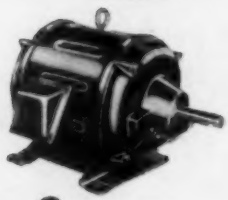
you'll save { time / money / worry

when you standardize on Wagner motors

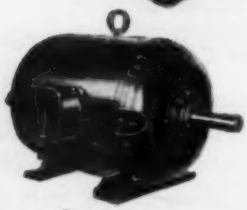
because of:

- Immediate Availability on Many Types and Sizes.
- Improved Engineering Features that Assure Long Life and Efficient Operation.
- A Liberal Warranty.
- A Wide Variety of Types and Sizes.
- Nationwide Service Facilities with Replacement Motors and Parts—*When You Need Them —Where You Need Them.*

Repulsion Start Induction Motor ⅛ to 15 h.p.



Open-type, Polyphase Squirrel Cage Motor ¼ to 400 h.p.



Explosion-Proof Motor ½ to 200 h.p.

Totally-enclosed, Fan-cooled Motor 1½ to 200 h.p.

Wagner Electric Corporation EST. WE 1891

Regardless of what your motor requirements may be, Wagner can furnish a standard motor to fit your needs. Twenty-nine branch offices, located in principal cities, are ready to assist you whenever you have a motor problem. Write for Bulletin MU-185 for information on the complete line of Wagner Motors.

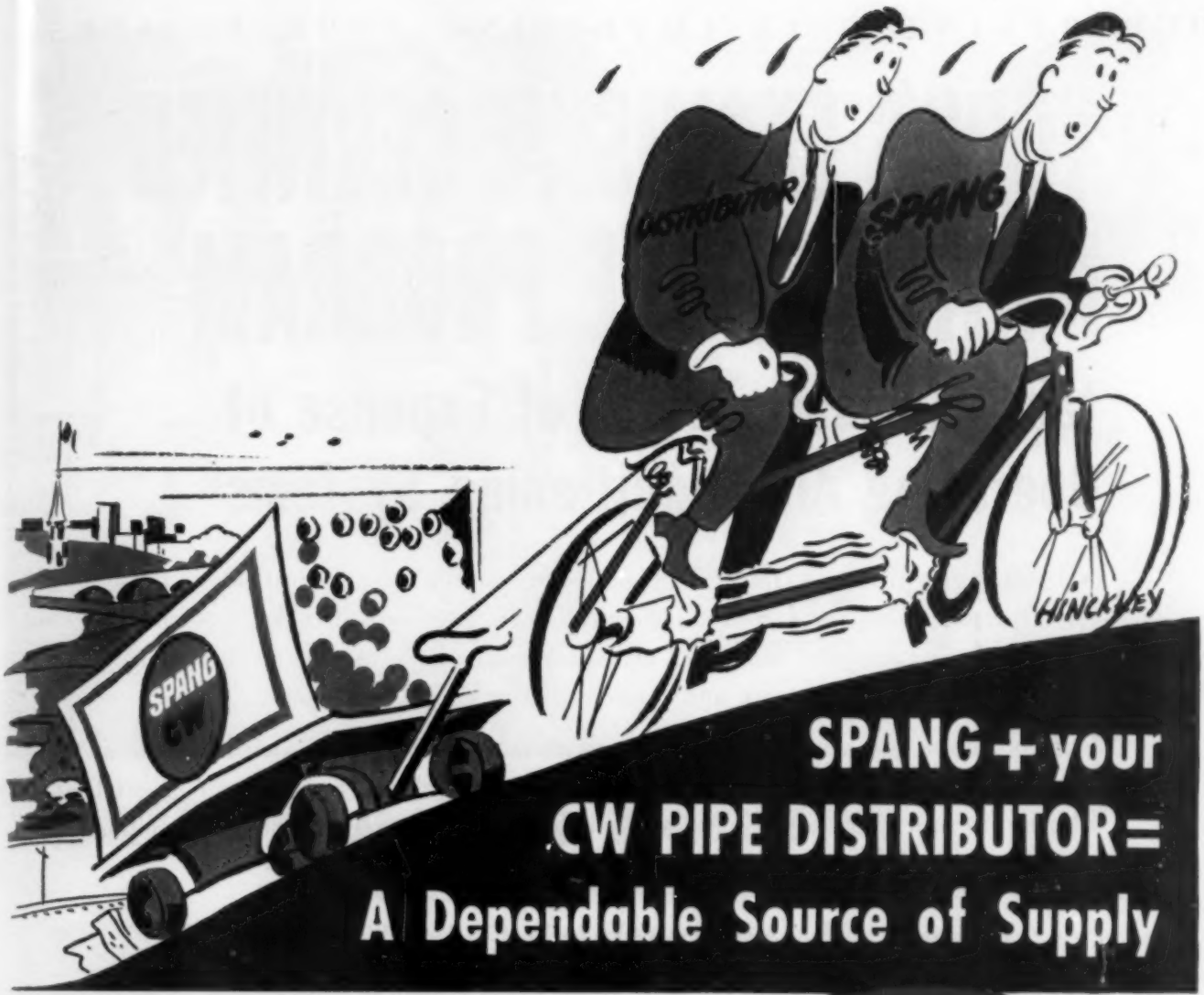
Wagner Electric Corporation

6370 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.

Consult Wagner Engineers on all Electric Motor Problems

M49-11

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE PRODUCTS



SPANG + your CW PIPE DISTRIBUTOR = A Dependable Source of Supply

●It takes real team work to establish a dependable source of supply . . . like the cooperation that exists between Spang and your CW Pipe Distributor. They pour everything into a united effort to give you the products and service you want.

Your Spang CW Distributor has built a streamlined organization to provide you with top-notch service on all the things he has for sale. While here at Spang we have streamlined our mill to protect and maintain the *quality* that has made Spang CW Pipe famous for over 100 years.

When you need pipe, fittings, fixtures, valves or other piping materials, contact your Spang Distributor first . . . *he's a dependable source of supply.*

SPANG-CHALFANT

Division of The National Supply Company

GENERAL SALES OFFICES: PITTSBURGH, PA.

District Sales Offices: Atlanta; Boston; Chicago; Detroit; Houston; Los Angeles; New York; Philadelphia; Pittsburgh; St. Louis; San Francisco

SPANG
CW

QUALITY *that is recognized wherever pipe is used*

YORK'S EXCLUSIVE CERTIFIED MAINTENANCE PROGRAM

takes Guesswork out of Expense of Operating Air Conditioning Systems

OWNER SATISFACTION in the system *you* recommend or install is important. To maintain full efficiency at all times and reduce overall operating costs, York offers owners of York air conditioning systems exclusive Certified Maintenance Contracts. These contracts assure satisfactory performance and result in better care of equipment.

YORK'S CERTIFIED MAINTENANCE PROGRAM is time-tested. Today thousands of these contracts are in effect—a remarkable tribute to a priceless service. Don't forget that in addition to superb quality of product, York offers this service to insure your client's satisfaction throughout the years.

York Recommends Your Services

That's basic philosophy with York. Wherever practical, York believes in channeling air conditioning work through *you* as representative of the ultimate user. To back up your recommendations and services, York provides this balanced program:

- **a complete line of equipment**
- **competitive prices**
- **accurate, dependable product ratings**
- **technical assistance based on "case histories"**
- **cooperation with architects, engineers, and contractors**
- **practical help from York-Trained Engineers**
- **a national organization**
- **continuous product research and development**
- **certified maintenance**

If you are "planning" any job requiring air conditioning or refrigeration, call your York District Office. Experienced Sales Engineers are available to give you *complete and personal* assistance at all times. York Corporation, York, Pennsylvania.

York refrigeration air-conditioning

PIONEERS IN INVENTION AND DEVELOPMENT SINCE 1874

Refrigeration and Air Conditioning

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

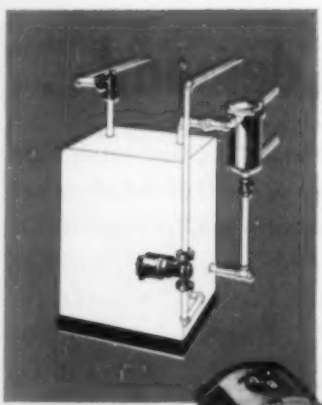
CONTROLLED
RADIANT
WARMTH

Plus

YEAR
'ROUND
HOT WATER

B&G *Hydro-Flo* Heating

offers the features most appealing to both men and women



This is the *forced hot water* system that provides radiant sunny warmth at its best . . . accurately controlled . . . easy on fuel. Its modern, comfort-economy benefits are obtainable with your choice of radiant panels, baseboards, radiators or convectors.

The B&G *Hydro-Flo* System adjusts itself to weather changes so smoothly that indoor temperature is uniformly constant . . . even in Spring and Fall when overheating usually occurs. And as a plus feature, an all-year supply of hot water for kitchen, laundry and bath, furnished by the same boiler that warms the house. Always plenty for showers and automatic washers . . . at minimum cost.

Hundreds of thousands of B&G *Hydro-Flo* Systems are in operation today . . . in homes, apartments, commercial and industrial buildings. *Get the facts now on today's preferred heating system!*

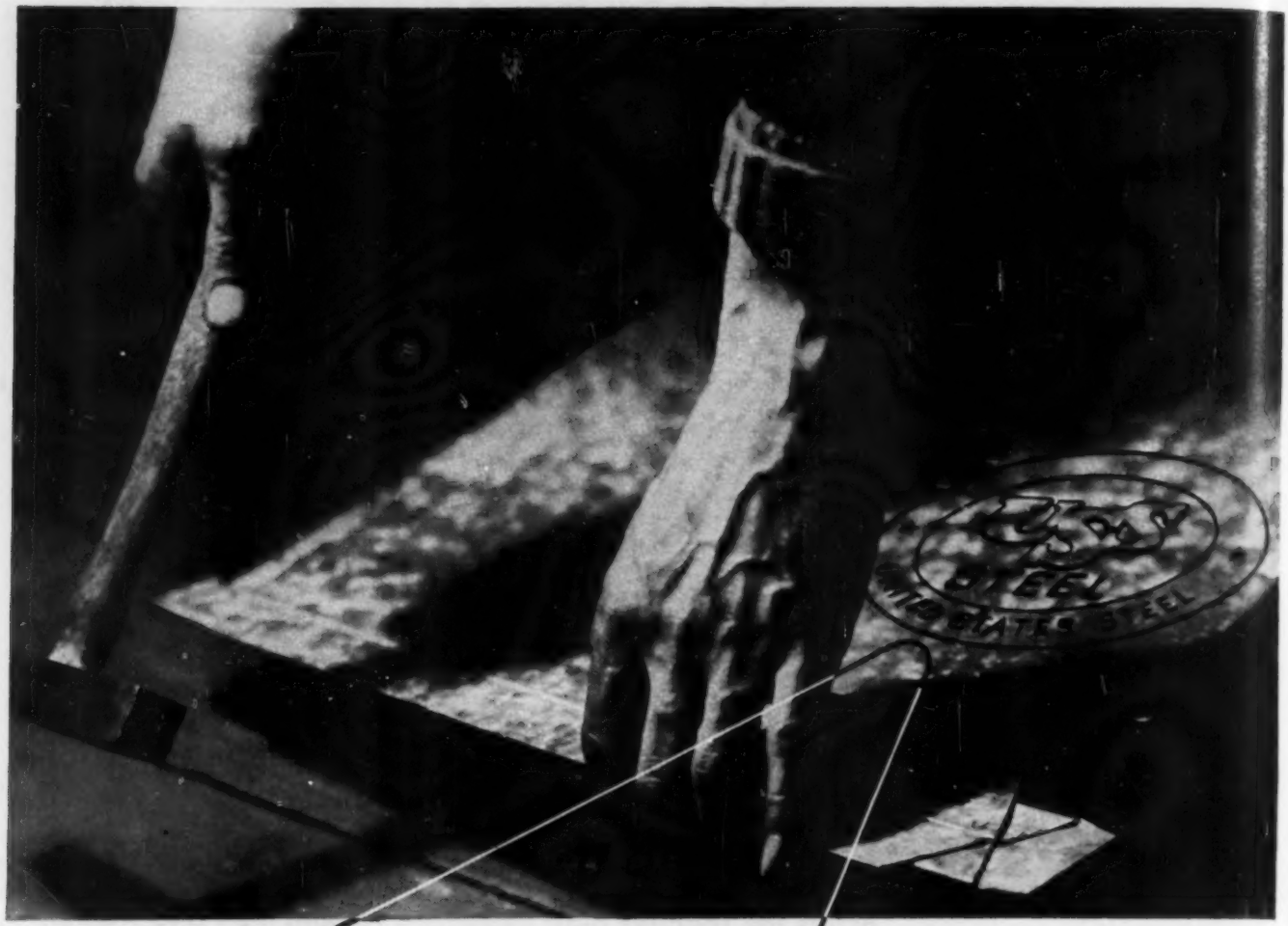
B&G *Hydro-Flo* Heating Equipment—Booster Pump, Flo-Control Valve, Relief Valve and Water Heater—can be installed on any hot water boiler.

Send today for the interesting booklet, "Capture the Sun," for the full story of B&G Hydro-Flo Heating.

BELL & GOSSETT *Company*

Dept. BG-5, Morton Grove, Illinois

*Reg. U.S. Pat. Off.



How's your stock?

Don't get caught short on sheets. Keep enough on hand to handle any size job! It will pay you to ask your jobber for those bearing the familiar U·S·S Trade-mark. It is your guide to the finest quality . . . and your customers' assurance that you are using the best sheets available.

The brand most in demand . . .

● Difficult shapes and angles are easy to make . . . true bend, tight seams and neat joints easy to obtain when you use U·S·S Galvanized Steel Sheets. Highly resistant to rust and corrosion, and uniform in surface, flatness and ductility, they may be bent, rolled, cut, and seamed with ease and accuracy. These superior forming characteristics result in speedier shop practice and better looking, more durable jobs.

Another reason it will pay you to use U·S·S Galvanized Steel Sheets is that they are the best-known, most widely advertised sheets in the industry. The familiar U·S·S Trade-mark stands for dependable quality. It gives the jobs you turn out greater sales appeal . . . assures greater customer satisfaction.

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

U·S·S STEEL SHEETS

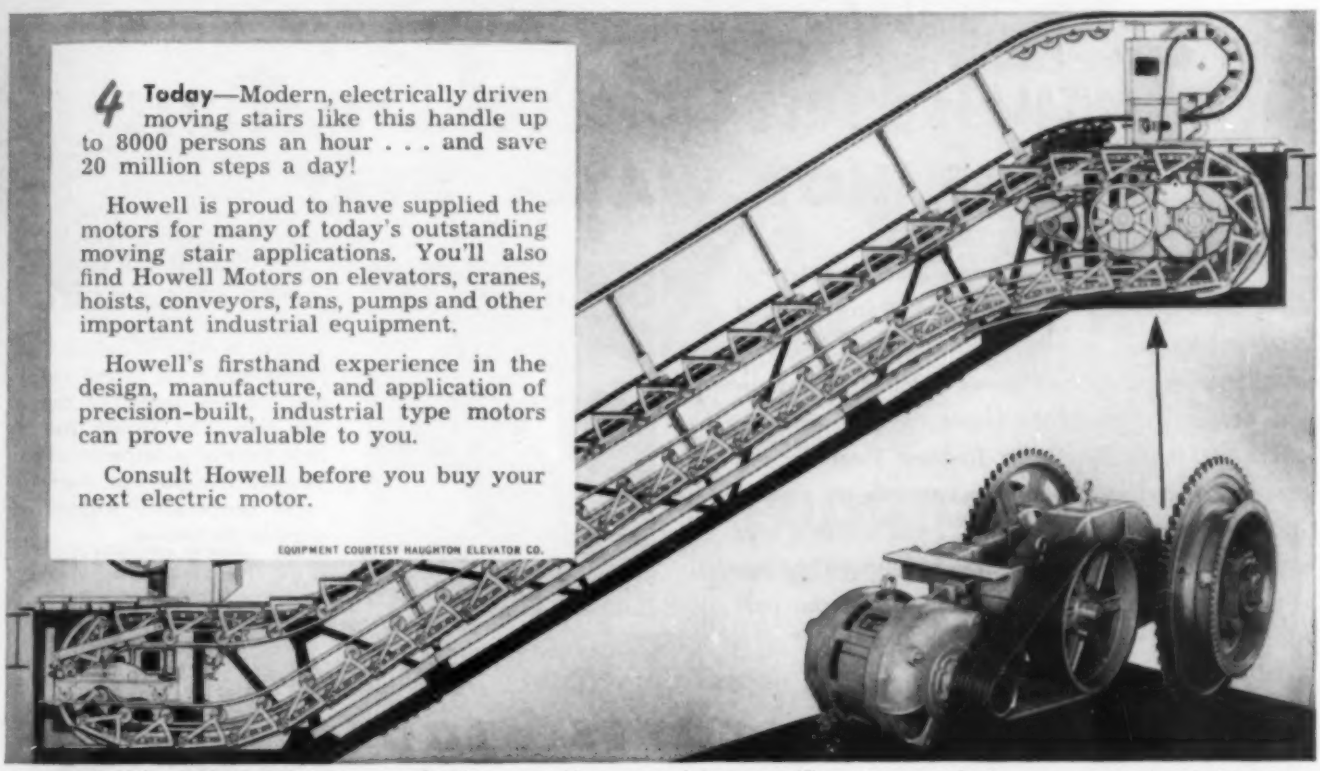
UNITED STATES STEEL

1 **1800**—For centuries, steps were man's main means of going up. First came the ladder; later, crude steps formed stairways. Even so, man still had to ascend a step at a time under his own power.

2 **1875**—Stairways took all forms—straight, spiral, plain and ornate. Then, one Samuel Gray patented an "elevator and moving stairway." Though impractical, his idea set others to work.

3 **1901**—The forerunner of today's moving stairs was installed in a New York store. By 1915, Howell "Red Band" Electric Motors arrived. Soon, these rugged motors were widely applied.

SAVED...20 MILLION STEPS A DAY!



4 **Today**—Modern, electrically driven moving stairs like this handle up to 8000 persons an hour . . . and save 20 million steps a day!

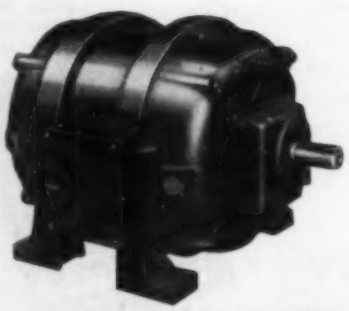
Howell is proud to have supplied the motors for many of today's outstanding moving stair applications. You'll also find Howell Motors on elevators, cranes, hoists, conveyors, fans, pumps and other important industrial equipment.

Howell's firsthand experience in the design, manufacture, and application of precision-built, industrial type motors can prove invaluable to you.

Consult Howell before you buy your next electric motor.

EQUIPMENT COURTESY HAUGHTON ELEVATOR CO.

Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.



Elevator Type Motor

HOWELL MOTORS

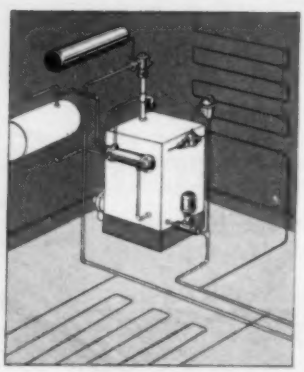
HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built Industrial Motors Since 1915

HOWELL Red Band MOTORS

Thrush Flow Control System
OF HOT WATER HEAT

EVERYBODY wants Radiant Heating! Give them Forced Circulating Hot Water Heat, of course, because it's mild, steady, economical, and ideally suited to radiant panel, baseboard, or radiator heating. Thrush Flow Control System not only offers the best control for Radiant Heating, but costs much less to install. The controls are simple, inexpensive, highly efficient . . . and assure a continuous flow of sunny warmth throughout the entire heating season without thought on the part of the owner.



RADIANT PANEL HEAT

FORCED CIRCULATING

Thrush System provides completely automatic forced circulation for new homes or conversion jobs. The Thrush Radiant Heat Control anticipates outdoor weather changes and maintains room temperature without noticeable fluctuation.

FLOW CONTROL VALVE

THRUSH WATER CIRCULATOR

LOW OPERATING COSTS, TOO!

Not only is Thrush System lower in cost because of the simpler and more efficient controls used, but it is also more economical of fuel. There is no overheating, never any chilly feeling, no drafts . . . and no fuel is ever wasted. A plentiful supply of domestic hot water is supplied all the year around by the same heating boiler, making further reductions in both installation and operating costs. It is ideal for zoning which may also effect installation and operating economies. Ask your wholesaler about it today, or address Dept. E-12 for interesting booklet and complete information.

H. A. THRUSH & COMPANY

PERU, INDIANA

IF INTERESTED SEND TODAY FOR THIS FREE BOOKLET

READY

In a Jiffy

TO THREAD

1" to 2" PIPE

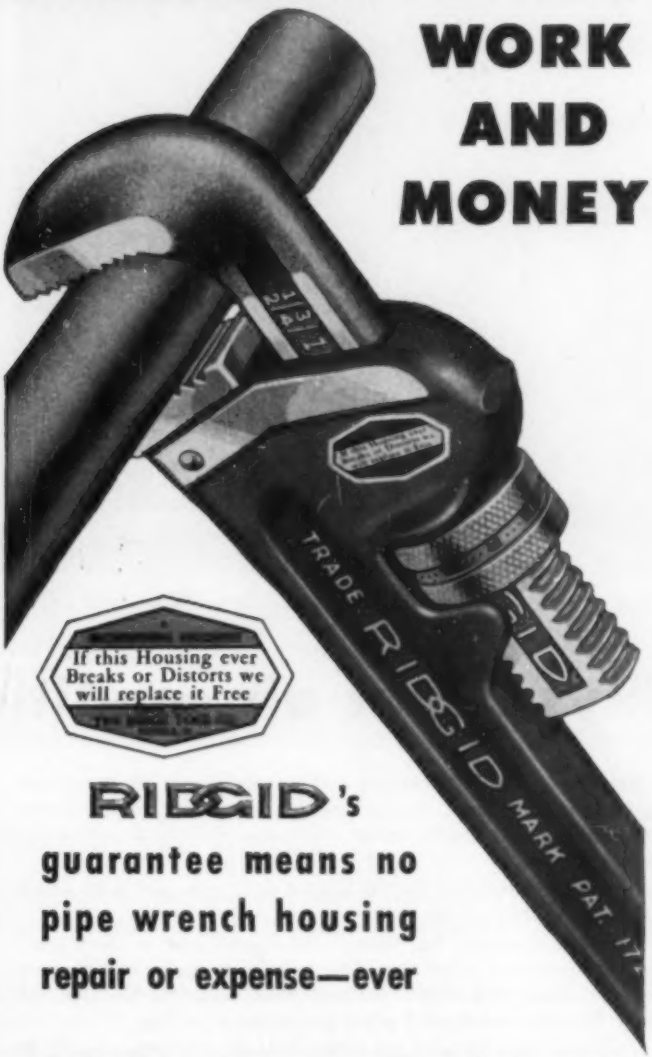
RIDGID No. 65R

gives real precision threads ...quickly and easily

● In just 10 seconds you're ready to cut fast, accurate threads on 1," 1¼," 1½," and 2" pipe. Workholder sets instantly — only one screw to tighten, no bushings. No. 65R is self-contained — has no extra dies for you to bother with or lose; one set of high-speed steel chaser dies does the trick on iron, steel, brass or copper pipe or conduit. Buy work-saver 65Rs from your Supply House.

World's Favorite-

BECAUSE IT SAVES WORK AND MONEY



RIDGID's

guarantee means no pipe wrench housing repair or expense—ever

● The famous RIDGID guarantee is just one of the features that make RIDGID the choice of millions the world over. You also like its free-spinning adjusting nut, handy pipe scale on hookjaw and comfort grip I-beam handle with flared end that keeps your hand from slipping off. For a work-saver that's a pleasure to use buy the world's favorite — RIDGID wrenches, 6" to 60," at your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS • THE RIDGE TOOL CO. • ELYRIA, OHIO

TRANE

Going! Going! Gone! Skyscraper air conditioning has progressed from large ducts to small, until now it requires no ducts at all—only ordinary water pipe.

Skyscraper air conditioning without ducts...

Ductwork—once the "necessary evil" of skyscraper air conditioning—may still be "evil," but no longer is necessary. Revolutionary new UniTrane air conditioning eliminates entirely the need for ducts.

UniTrane is designed for the largest skycraper, and it fits small multiroom buildings, too.

It is a unit system, but there is no compressor or other complicated apparatus in the unit. Simple piping, similar to hot water heating—illustrated above—carries warm water to the unit for winter heating and chilled water for summer cooling.

UniTrane may be used for either new or remodeling work. It is so simple and so flexible that it can be installed a bit at a time if desired. It is practical and economical to make the original UniTrane installation for straight heating only, with cooling to be added later. Or units may be installed and operated in a wing, a floor, or a zone without disturbing other existing equipment.

Type MC UniTrane provides individual room control of temperature, moisture, and ventilation. All air is filtered. There is no mixture of air between rooms or corridors.

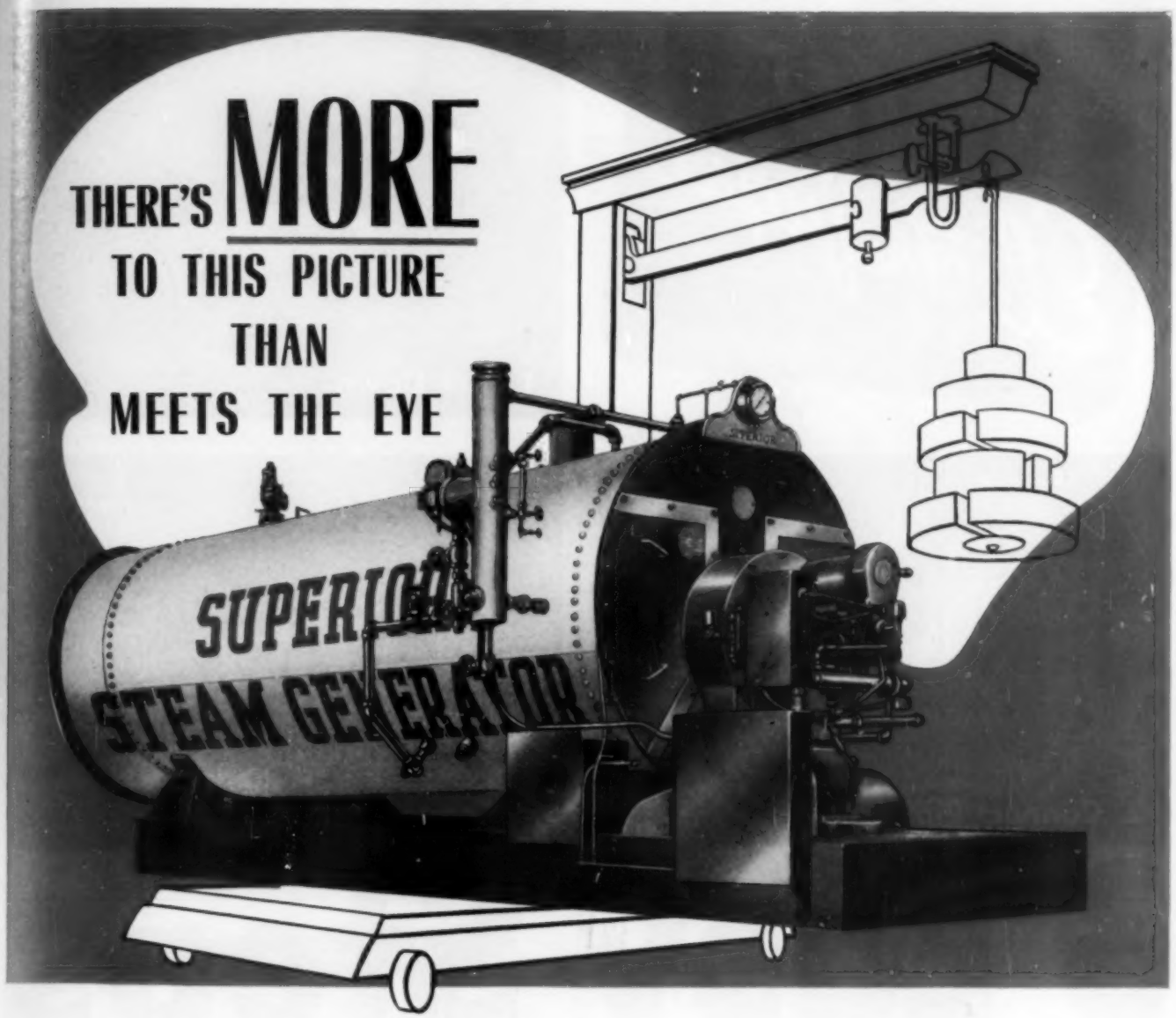
Each room has its own year-around air conditioning system, all contained in a compact package that fits under the window.

Ask the Trane sales office in your area for a copy of "Merely a Matter of Air," which covers the ABC's of skyscraper air conditioning in general, from bulky central systems to ductless UniTrane.

THE TRANE COMPANY...LA CROSSE, WIS.

Manufacturing Engineers of Heating, Ventilating and Air Conditioning Equipment—Unit Heaters, Convector-radiators, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat Exchange Equipment, Steam and Hot Water Heating Specialties... IN CANADA, TRANE COMPANY OF CANADA, LTD., TORONTO.

UniTrane room units are beautifully styled for under window installation in offices, hotels, hospitals and other multiroom buildings. Data bulletin DS-420 is for architects and engineers..."Merely a Matter of Air" is for the non-technical reader.



What's this . . . steam generators by the pound?

But doesn't it make sense that greater heating surface and larger steaming areas go hand-in-hand with increased weight? And doesn't sturdy, rugged, built-for-life construction add even more weight?

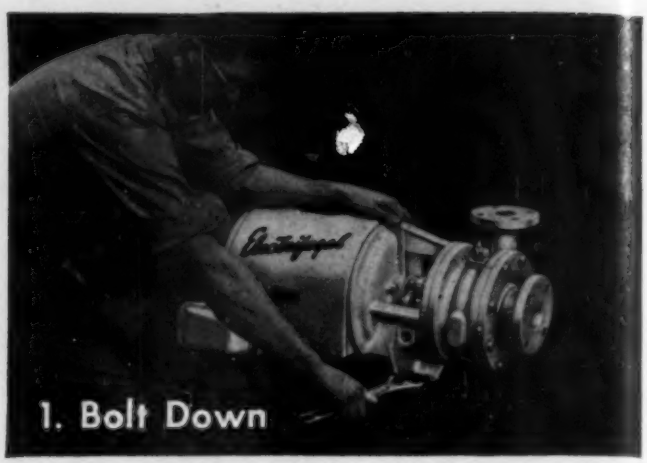
Of course it does . . . and that's a thought which tips the balance with consulting engineers who specify *Superior* Steam Generators. For after weighing all the factors of unit purchase with undivided responsibility, completely automatic operation with any kind of oil or gas, induced draft which eliminates the need of a chimney, simple installation, and guaranteed thermal efficiency in excess of 80% . . . after all this, specifying engineers look for long-lived dependability . . . and find it in Superior's rugged construction, ample steam space and larger heating surfaces . . . the features which make Superior Steam Generators weigh more.

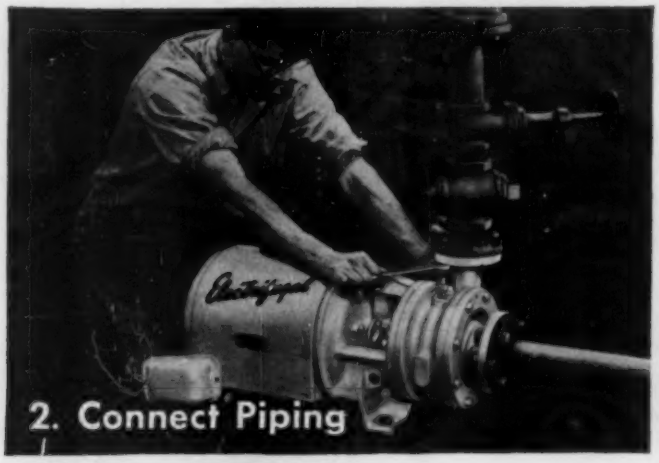
Superior Steam Generators are available in capacities from 20 to 500 b. h. p. for pressures up to 250 p. s. i. For complete details write for catalog 104.

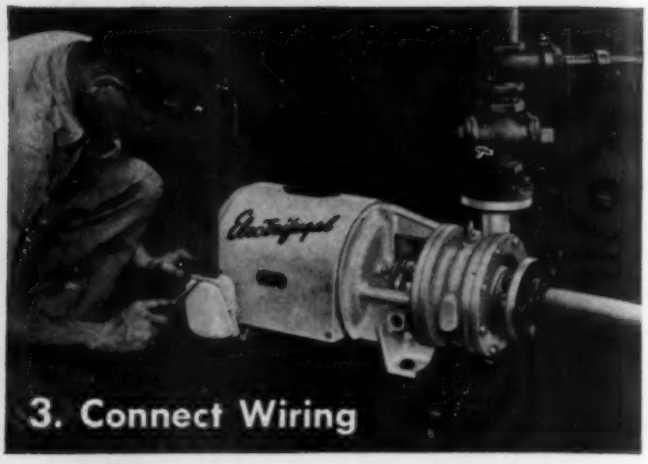
Superior Combustion Industries, inc.

Factory Emmaus, Pa
Executive Offices Times Building, Times Square, New York 18, N. Y.

Electrifugal PUMP







3 Easy Steps

...AND YOU'RE READY TO PUMP

- **No Alignment Problem**
- **No Extra Parts To Buy**

You save hours of expensive installation time with *Electrifugal* pumps because the pump and motor are built as a single complete unit, shipped READY TO RUN. Note that cast iron yoke and bracket for mounting pump are a *single-piece*—eliminating a separate adapter. And because motor and pump are on a *single* shaft, perfect and permanent alignment are assured. No couplings or other extra parts to buy. Maintenance costs less, too, because pump and motor cannot get out of alignment. Packing gland is readily accessible.

The Electrifugal pump, ranging from 10 to 1600 gpm with heads to 525 feet, is just one of many types of pumps built by Allis-Chalmers for industrial uses. You can count on the recommendations of the A-C pump application engineer. For information, see your Allis-Chalmers Authorized Dealer or Sales Office, or write for Bulletin 52B6059E. A-2769

Electrifugal, Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS, 1171A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

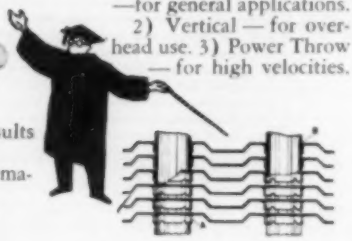
TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

Things to think about when selecting Unit Heaters

DISCHARGE AIR TEMPERATURE*

Teeter-totter temperatures are out of the question in buildings heated by Modine Unit Heaters. Modine's *right* combination of correct outlet temperature and sufficient air velocity heats all parts of a room uniformly, even in coldest weather.

Modine's wide line gives you the right unit for your needs: 1) Horizontal —for general applications. 2) Vertical — for overhead use. 3) Power Throw — for high velocities.



Higher heat transfer results from quality Modine construction which permanently seals flanged collars of fins (A) to tubes (B) by means of metallic bond.

**For maximum comfort and lowest operating cost, temperature of air leaving unit heater should be between 110°-120°F. at standard conditions.*

LOWER COSTS

Fuel bills shrink when you heat with Modines. Here's why. Modine Unit Heaters — combining correct outlet temperatures with sufficient air velocity — deliver heat down into comfort zones where it's needed . . . don't waste it on ceilings or above the heads of room occupants.

Direct-from-pipe suspension is safe and practical with Modine horizontal models. *This cuts installation costs . . . permits easy redirection of heat over a 360° range.*

Lower power and motor maintenance costs result from Modine's use of only high-quality, totally enclosed split-phase or capacitor motors on all but only the smallest Modine Unit Heaters.

LONGER LIFE

Modine Unit Heaters are built to last. With the complete condenser constructed of pure copper and copper alloy . . . with tubes of red brass, fins and headers of copper, you get maximum resistance to electrolysis and corrosion.

Differential expansion stresses are safely absorbed in individual tubes. Fins are permanently bonded to tubes with metal. All condenser joints are brazed.

Parker-Bonderizing protects casings and sheet metal parts against formation and spread of rust. Anchors paint to steel. Prolongs original attractive finish.

Modine
UNIT HEATERS

Yes . . . look beyond BTUs when buying Unit Heaters. Look to Modine! You can get all the facts by calling your nearest Modine Representative. He's listed in the classified section of your phone book. Or write direct. Modine Mfg. Co., 1509 Dekoven Ave., Racine, Wisconsin.

Ask for the new Modine Unit Heater Bulletin 149A. Also available on special request is the informative booklet — "Here's How to Evaluate Operating Characteristics of Suspended Unit Heaters." Send for them today!

U-1037

SIZE STANDARDIZATION MEANS QUICK SELECTION...

Tri-Flex

FOR SUPPLY

26 SIZES

8 x 4	24 x 5
10 x 4	24 x 6
10 x 6	24 x 8
12 x 4	24 x 10
12 x 5	24 x 12
12 x 6	30 x 6
14 x 4	30 x 8
14 x 5	30 x 10
14 x 6	30 x 12
16 x 5	36 x 8
16 x 6	36 x 10
20 x 5	36 x 12
20 x 6	
20 x 8	

Now you can eliminate the haphazard specification of grilles and registers that can be so troublesome. The Tri-Flex line (for supply) has been standardized in 26 popular sizes that meet the requirements of every commercial, industrial and institutional air-conditioning job. Selection is quick, easy and accurate . . . just check the list of Tri-Flex standards and select the sizes you need for your next installation.

And, when it comes to AEROVANE (for return), in 20 standard sizes . . . the same simplified selection advantage.

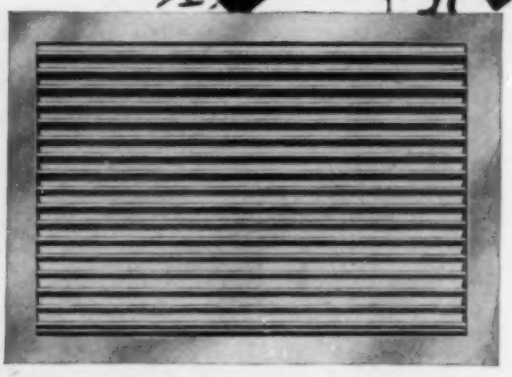
TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

Aerovane

FOR RETURN

. . . CUTS COSTS AND MEANS PROMPT DELIVERY, TOO



You'll complete your next job quickly, and you'll cut costs doing it, with Standard AEROVANE and TRI-FLEX Grilles and Registers. Size standardization means efficient mass production . . . results in real savings to you. And, you'll get prompt shipment . . . *all standard items are carried in stock.*

Individually packaged in sturdy cartons . . . units are protected from damage in transit or on the job . . . easy-to-read labels facilitate sorting and locating.

20 SIZES

10 x 6	24 x 24
10 x 8	30 x 12
12 x 6	30 x 18
12 x 8	30 x 24
12 x 12	36 x 18
18 x 6	36 x 24
18 x 12	36 x 30
18 x 18	48 x 24
24 x 12	48 x 30
24 x 18	48 x 36

TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

• For detailed description, engineering data and complete selection information . . . write today for a copy of Catalog 485.

7YB49

WORTHINGTON AIR CONDITIONING REPORT

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, NEW JERSEY

Specialists in air conditioning and refrigeration for more than 50 years

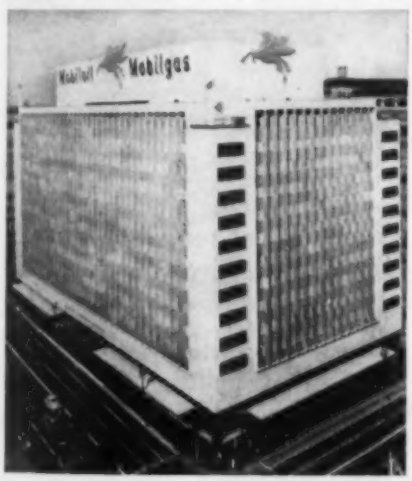
New Weather-Making Plant Has Finger-Tip Control

Thermostats Each 14 Feet, Four Fan Rooms On Each Floor, Assure Flexibility

A weather factory huge enough to turn out a ton of ice every day for every office in the new General Petroleum building, but sensitive enough to supply a different temperature every fourteen feet throughout the entire half-million square foot structure . . . that's the heating and air conditioning plant in General Petroleum Corp.'s new building in Los Angeles.

Basic approach in design of the equipment, which was done by the office of Ralph E. Phillips, consulting mechanical and electrical engineers, was determined by Southern California weather which may require the building to be heated and cooled simultaneously. One duct brings cooled air and the other heated air to all portions of the building.

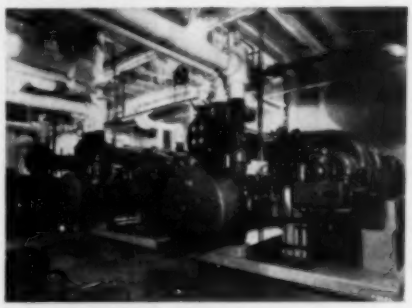
The outlets are spaced to fit the modular design of the building which is on a 14 and 7 foot plan. Outlets are located each 14 feet on most floors; a few floors, where smaller offices



may be used, have outlets every 7 feet.

Each outlet has its own thermostatic control—more than a thousand controls altogether. Since most offices are 14 feet in width, that means each office can choose its own weather.

The controls operate dampers



which automatically mix the hot and cold air to provide the desired temperature. A minimum of six and an average of eight complete air changes hourly are provided.

Feeding the air to the twin-duct system are 48 fan rooms. Four are located on each floor from the second to the top floor of the 13-story building. Each fan room contains heating and cooling coils and a 3 horsepower electrically driven fan flowing 7500 cfm.

The refrigeration plant consists of three Worthington 300-hp centrifugal compressors, using "Freon 11", with a capacity of 333 tons each. Chilled water from the refrigeration plant is circulated to the cooling coils in the fan rooms, from where the cooled and conditioned air is distributed throughout the building. Cooling towers are located on the roof.

W. S. Kilpatrick & Company, Los Angeles, contractors. Wurdeman & Becket, Los Angeles, Architects.

Hot News Gets Cooled Off

The Nashville Tennesseean and the Nashville Banner are published in Newspaper Printing Corp.'s air conditioned building.

The entire building, with the exception of the press room with its large printing roll presses, is air conditioned with Worthington equipment. Executive offices have individual temperature control. Multiple zone control for the building is provided by using face and by-pass dampers plus hot water reheat.

Air conditioning is provided by a Worthington centrifugal refrigeration system with a 150 ton refrigeration capacity. Chilled water is distributed to nine AVY and AHY type central plant air conditioning units which have chilled water cooling coils. A Worthington chilled water pump and two tower pumps complete the equipment for the system

Architects and Engineers: Marr & Holman, Nashville. Contractors: J. M. Gallagher Co., Nashville.

Looks . . . and Feels Different

The Kaufman Department Store in Colorado Springs, Colorado, starts its 54th year in business with a new look and a different climate. All three floors of the store are air conditioned with Worthington equipment, which includes a 6HF4 Freon-12 condensing unit and a 4HF4 Freon-12 condensing unit. The latter controls temperature of basement and first floor, the 6HF4 unit controls second floor. Zone control is used by both. Consulting engineer: Douglas Jardine, Colorado Springs, Colorado.

A9-21

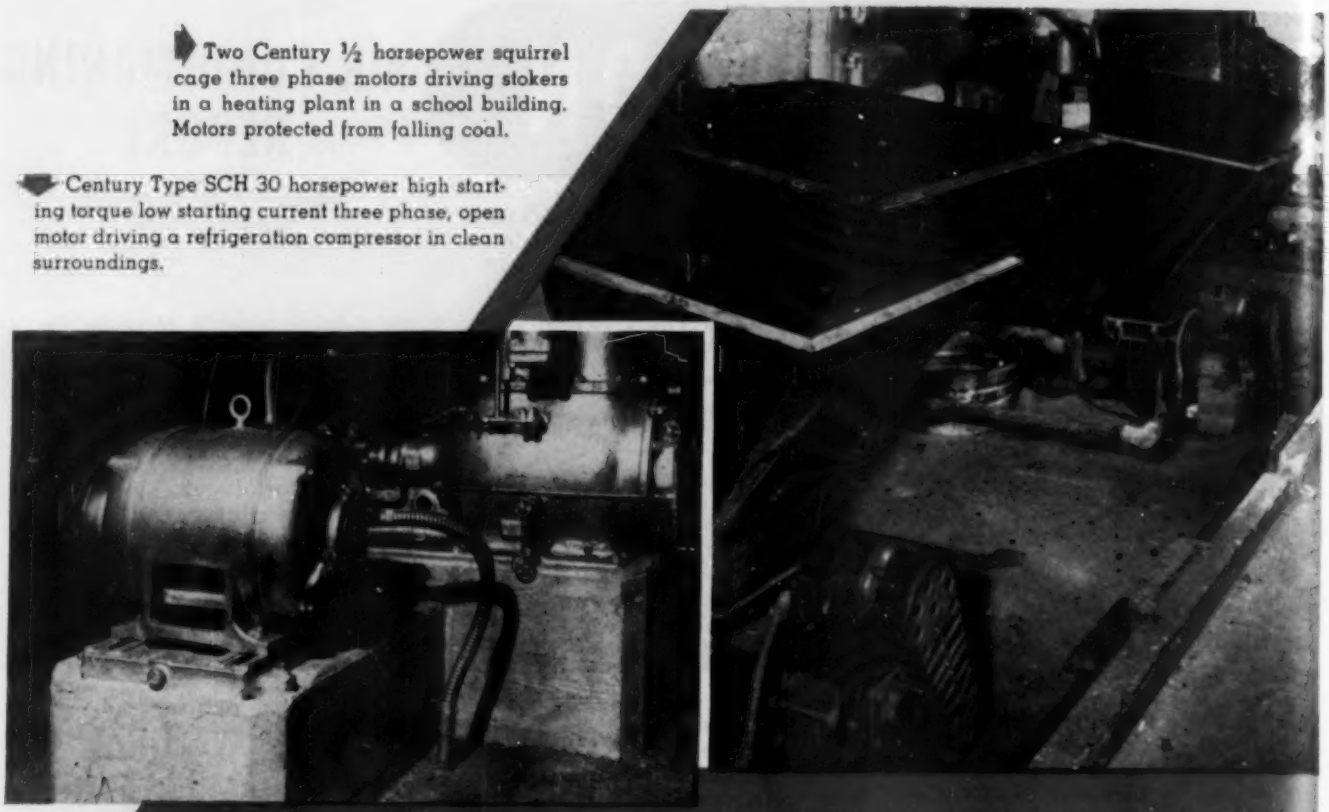
WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

A complete line . . . in which *all* the vital components are *made*, not just assembled by Worthington. For *more worth with Worthington*, see your nearby Worthington distributor (consult Classified Telephone Directory).

Two Century ½ horsepower squirrel cage three phase motors driving stokers in a heating plant in a school building. Motors protected from falling coal.

Century Type SCH 30 horsepower high starting torque low starting current three phase, open motor driving a refrigeration compressor in clean surroundings.



From Century's Wide Range of Types and Sizes

You Can Select the RIGHT CENTURY MOTOR to Provide LONG CONTINUOUS OPERATION

Many thousands of types and kinds of Century motors are available to satisfy all popular electric power requirements. You can be confident that the *right* Century motor on your equipment will provide a long life of satisfactory performance.

Century motors must pass 3 tests that assure satisfactory operation: (1) The exacting tests at the Century factory; (2) the tests of the thousands of manufacturers who install Century motors on their equipment, and (3) the satisfactory performance of these motors in the hands of the final user.

Century builds a wide range of types and kinds of electric motors, in sizes from 1/6 to 400 horsepower.

Specify Century motors for all of your electric power requirements.

Popular types and standard ratings are generally available from factory and branch office stocks.

Century C MOTORS

-612

CENTURY ELECTRIC COMPANY • 1806 Pine St., • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

For every piping equipment need ...Look to CRANE for complete selection

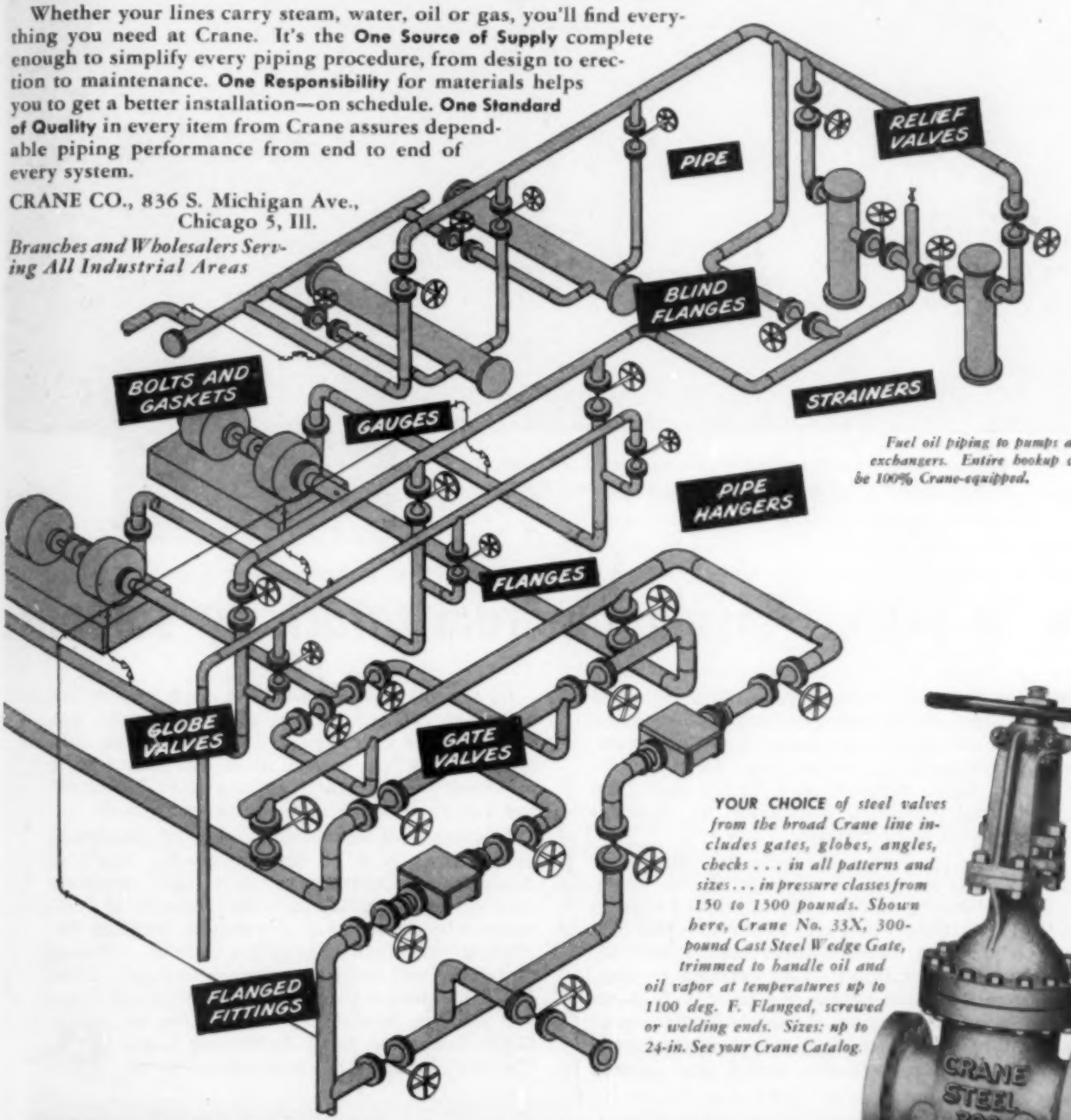
Look at This Fuel Oil Piping, for example. Every item in the system can be supplied by Crane. Yet all equipment shown here represents but a small part of the complete selection available to you when you order through your local well-stocked Crane Branch or Wholesaler. One order covers everything for the job—valves, fittings, pipe and accessories . . . of finest quality brass, iron, steel and corrosion-resistant alloys.

ONE SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

Whether your lines carry steam, water, oil or gas, you'll find everything you need at Crane. It's the **One Source of Supply** complete enough to simplify every piping procedure, from design to erection to maintenance. **One Responsibility** for materials helps you to get a better installation—on schedule. **One Standard of Quality** in every item from Crane assures dependable piping performance from end to end of every system.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.

Branches and Wholesalers Serving All Industrial Areas



Fuel oil piping to pumps and exchangers. Entire hookup can be 100% Crane-equipped.

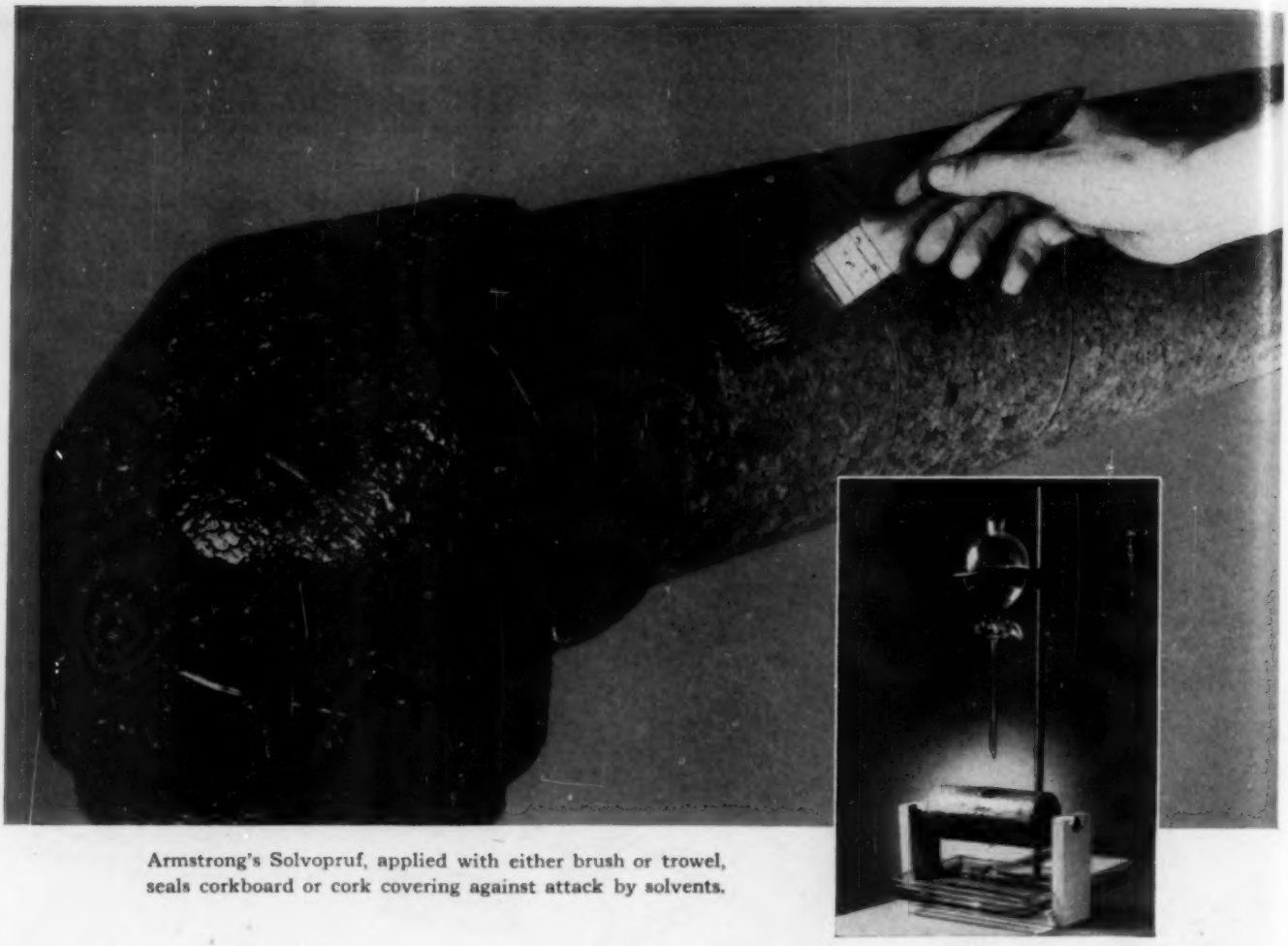
YOUR CHOICE *of steel valves from the broad Crane line includes gates, globes, angles, checks . . . in all patterns and sizes . . . in pressure classes from 150 to 1500 pounds. Shown here, Crane No. 33X, 300-pound Cast Steel Wedge Gate, trimmed to handle oil and oil vapor at temperatures up to 1100 deg. F. Flanged, screwed or welding ends. Sizes: up to 24-in. See your Crane Catalog.*

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM



Armstrong's Solvopruf, applied with either brush or trowel, seals corkboard or cork covering against attack by solvents.

How to protect insulation from attack by solvents

Cork insulation can now be thoroughly protected against the deteriorating effects of solvents. This is made possible by Solvopruf, a new compound developed by Armstrong. Solvopruf resists the liquid solvents and fumes that may attack vital insulated cold lines in chemical process plants and refineries.

This new product is specially formulated for use either as an adhesive or a protective finish. It is a self-curing compound that can be applied by brush or trowel and sets to a rubberlike film in two hours at room temperatures. It will remain in this condition when exposed to temperatures from 35° below zero to 125° F. After about a week of aging, Armstrong's Solvopruf is resistant to the action of toluol, methyl ethyl ketone, gasoline, kerosene, water, and benzol.

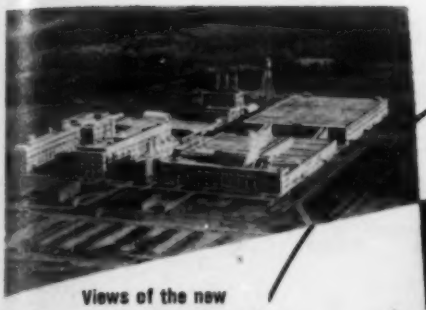
In one oil refinery where solvent vapors are a special problem, Armstrong's Solvopruf was applied three years ago to cork covering on cold lines. In this test, as well as in extensive testing in Armstrong's Research Laboratories, Solvopruf has satisfactorily withstood solvent attack.

Meeting and solving all types of insulation problems is part of the day-to-day work of Armstrong's Contract Service. This complete contracting organization offers buyers of low-temperature insulation a complete package, including qualified engineering advice, efficient materials, and skilled mechanics to apply them. For full information on this service, write today for the free booklet, "People Make A Good Insulation Job." Armstrong Cork Co., 4412 Concord St., Lancaster, Penna.

ARMSTRONG'S INDUSTRIAL INSULATIONS

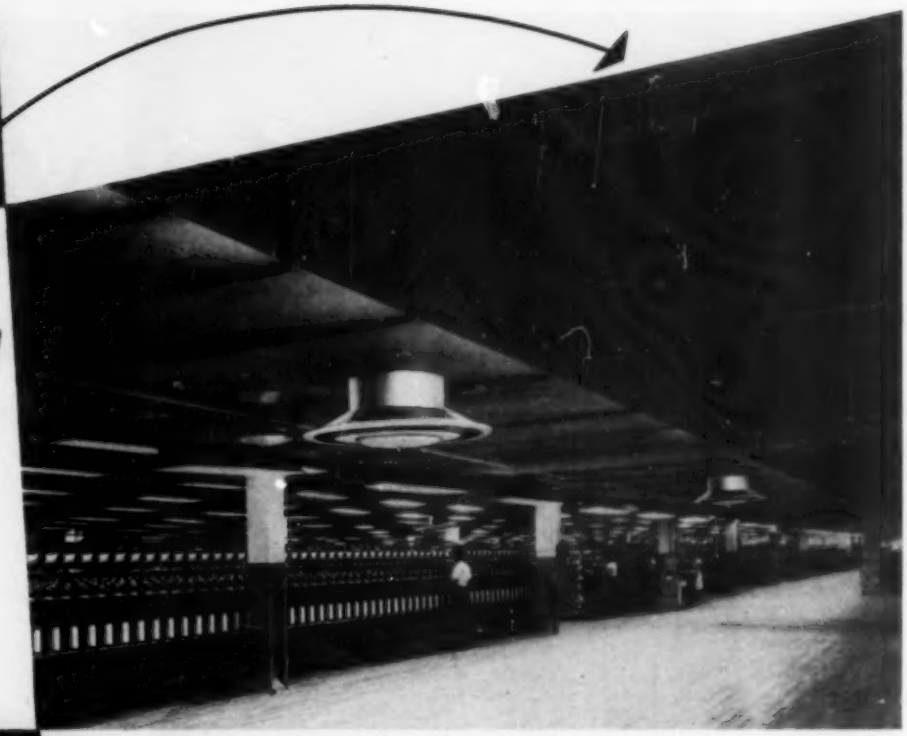
MATERIALS Ⓐ INSTALLATION

FOR ALL TEMPERATURES FROM 300° F. BELOW ZERO TO 2800° F.



Views of the new Celriver Plant of Celanese Corp. of America near Rock Hill, S. C., in which 409 Kno-Draft Diffusers are installed.

Carrier Corporation, Air Conditioning Engineers and Contractors

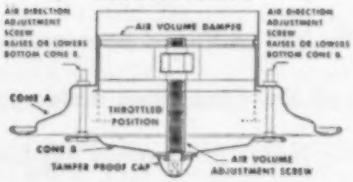


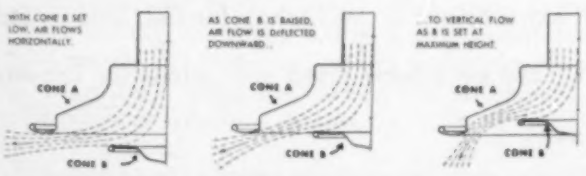
Kno-Draft

. . . the completely adjustable Air Diffusers chosen again by Celanese Corporation for another large new plant.

With features like these, adjusting and balancing is a matter of a few minutes.

PAT. & PAT. PENDING


AIR DIRECTION ADJUSTMENT SCREW RAISES OR LOWERS BOTTOM CONE B.
AIR VOLUME DAMPER
AIR DIRECTION ADJUSTMENT SCREW RAISES OR LOWERS BOTTOM CONE B.
CONE A
THROTTLED POSITION
CONE B
TAMPER PROOF CAP
AIR VOLUME ADJUSTMENT SCREW


WITH CONE B SET LOW, AIR FLOWS HORIZONTALLY.
CONE A
CONE B
AS CONE B IS RAISED, AIR FLOW IS DEFLECTED DOWNWARD.
CONE A
CONE B
TO VERTICAL FLOW AS B IS SET AT MAXIMUM HEIGHT.
CONE A
CONE B

For complex operating conditions that put air diffusers to a real test, few installations surpass a modern textile plant. Here air distribution is a vitally important part of quality control. Many processes require positive temperature and humidity control to within 1 degree. High-speed textile machinery develops hard-to-handle heat gain patterns. Myriads of winding threads require the absolute elimination of drafts. Kno-Draft air diffusers have been chosen repeatedly for Celanese plants because a succession of installations have proved their ability to meet the most critical operating conditions.

Kno-Draft facility for delicate regulation of air volume and direction enables air conditioning engineers to produce precisely the air pattern best suited for each area, even to blanketing a source of heat generation where necessary. And since Kno-Draft diffusers can be adjusted *after installation*, engineers are able to change the air distribution pattern whenever people, partitions, or processes are relocated.

SEND COUPON for handbook containing complete information on Kno-Draft Diffusers and all the necessary installation data.

W. B. CONNOR ENGINEERING CORP.

Air Diffusion • Air Purification • Air Recovery

112 East 32nd Street CONNOR New York 16, N. Y.

IN CANADA: Douglas Engineering Co., Ltd., 190 Murray Street, Montreal 3, P. Q.

W. B. CONNOR ENGINEERING CORP.

Dept. D-90, 112 East 32nd Street, New York 16, New York

Please send my FREE copy of the new Kno-Draft Handbook on Adjustable Diffusers.

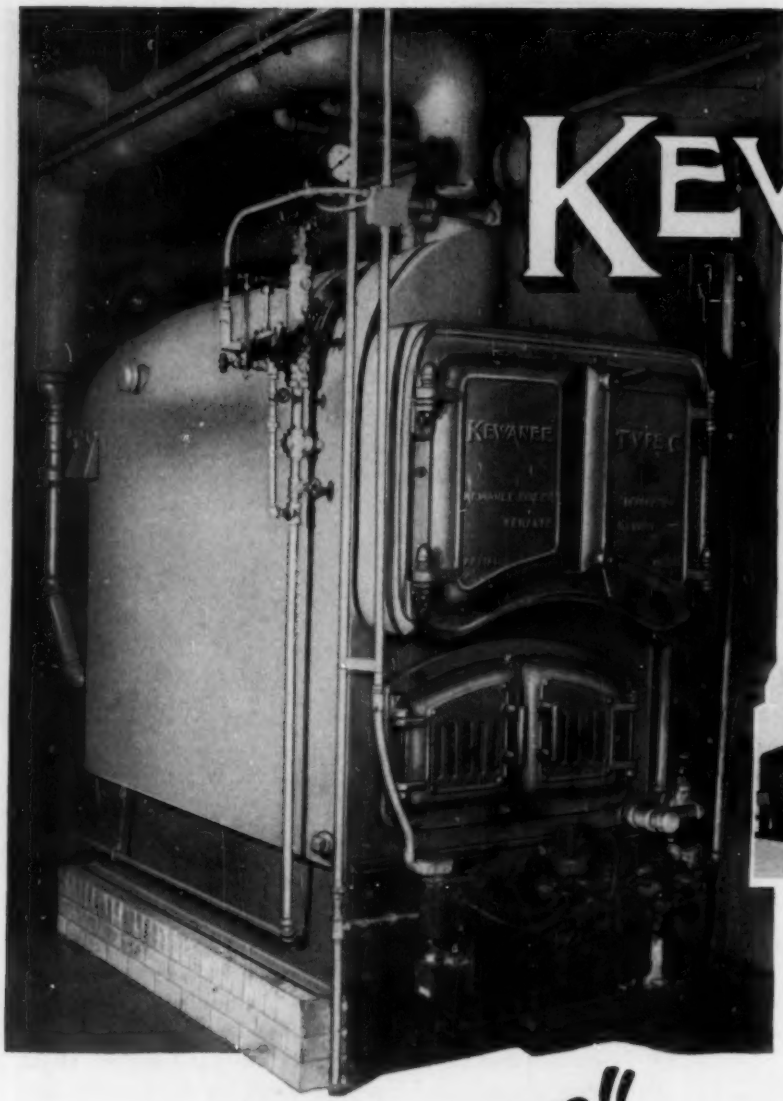
Name.....

Position.....

Company.....

Street.....

City..... Zone..... State.....



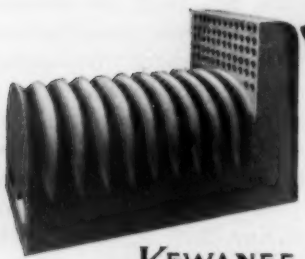
KEWANEE®

Type C STEEL BOILER

J. C. PENNEY CO., Building
North Kansas City, Mo.
Kivett and Myers, Kansas City, Architects
A. D. Jacobson Plbg. and Htg. Co.

A Kewanee 7L78 Type "C", Oil Fired, generates 1,313,000 Btu to heat 24,500 sq. ft. floor area.

"TOPS" FOR HEATING BIG BUILDINGS



KEWANEE
C-O-R-R-U-G-A-T-E-D CROWN SHEET
adds strength and provides additional heating surface over the hottest part of the fire. The crown sheet is right-side UP and self draining.

An ability to produce low pressure steam *at low cost* . . . a design that fits handily into restricted floor area . . . PLUS the extra-dependability of all Kewanee Steel Boilers . . . has made Type "C" the outstanding boiler for heating big buildings. Designed with extra height in the firebox for Oil, Gas or Stoker firing, Type "C" can be quickly fitted with grates for conversion to hand-fired coal.

KEWANEE BOILER CORPORATION

BOILERMAKERS 80 YEARS KEWANEE, ILLINOIS
Branches in 60 Cities—Eastern District Office: 40 West 40th Street, New York City 18
Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

Serving home and industry

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go these

RIC-WIL

PREFABRICATED PIPE UNITS

The most recent extension of the Ohio Edison Company's Central Heating System in Akron, Ohio was speeded to completion by the installation of these "around-the-corner" Ric-wiL Pre-fabricated, Pre-insulated Pipe Units.

With 14″ pipe and insulation housed in corrugated ingot iron conduit, factory prefabricated to the above configuration, these units are among the many Ric-wiL sub-assemblies forming the 975 foot artery which supplies steam from Ohio Edison's Beech St. Plant to various distribution centers.

For more complete detailed information on Ric-wiL Insulated Piping Systems write: The Ric-wiL Company, Cleveland, Ohio, Department 2U.

Specified Ric-wiL Units exemplify Ric-wiL's scientific approach to piping problems with resultant efficiency and economy. Ric-wiL Units are accurately designed and shaped to permit free flexure of entire piping systems in all planes with a minimum lineal footage of piping.

Prefabrication is under rigid engineering control with exact adherence to specifications, assuring simplified, low-cost installation and dependable, uninterrupted service with long life and outstanding durability.

RIC-WIL

INSULATED PIPING SYSTEMS

THE RIC-WIL COMPANY • CLEVELAND, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

DELCO PRODUCTS has been in the business of building appliance motors for a good many years. We've been in it long enough to know that latitude must be allowed for last-minute changes in customers' scheduling.

For Delco Products has a sound concept of service. Our experience has taught us to appreciate the manifold problems a manufacturer runs up against. All our resources are organized to help meet them promptly and smoothly . . . to deliver on time.

It's this human, personal quality as well as our complete, modern engineering and manufacturing facilities that makes Delco Products a byword for the finest in appliance motors.

DELCO PRODUCTS DAYTON, OHIO

DELCO MOTORS

DELCO PRODUCTS

Division of General Motors Corporation, Dayton, Ohio

Sales Offices: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HARTFORD, CONN.

Springtime in the Rockies.

What! REFRESHING MOUNTAIN AIR FOR BUSINESS?

Fresh, invigorating air like this? Why not!

You can boost morale and improve working conditions in any plant by installing American Blower Equipment.

For American Blower makes everything from equipment for complete air conditioning jobs to individual units for heating, ventilating and air handling.

Take the Utility Set, shown on the right, for example. This compact, quiet-operating unit for furnishing fresh air, removing bad air, fumes and odors is by far and away the most popular fan of its type in America.

Utility Sets are available in a wide range of capacities, with direct or V-Belt drive and with Aileron Control.

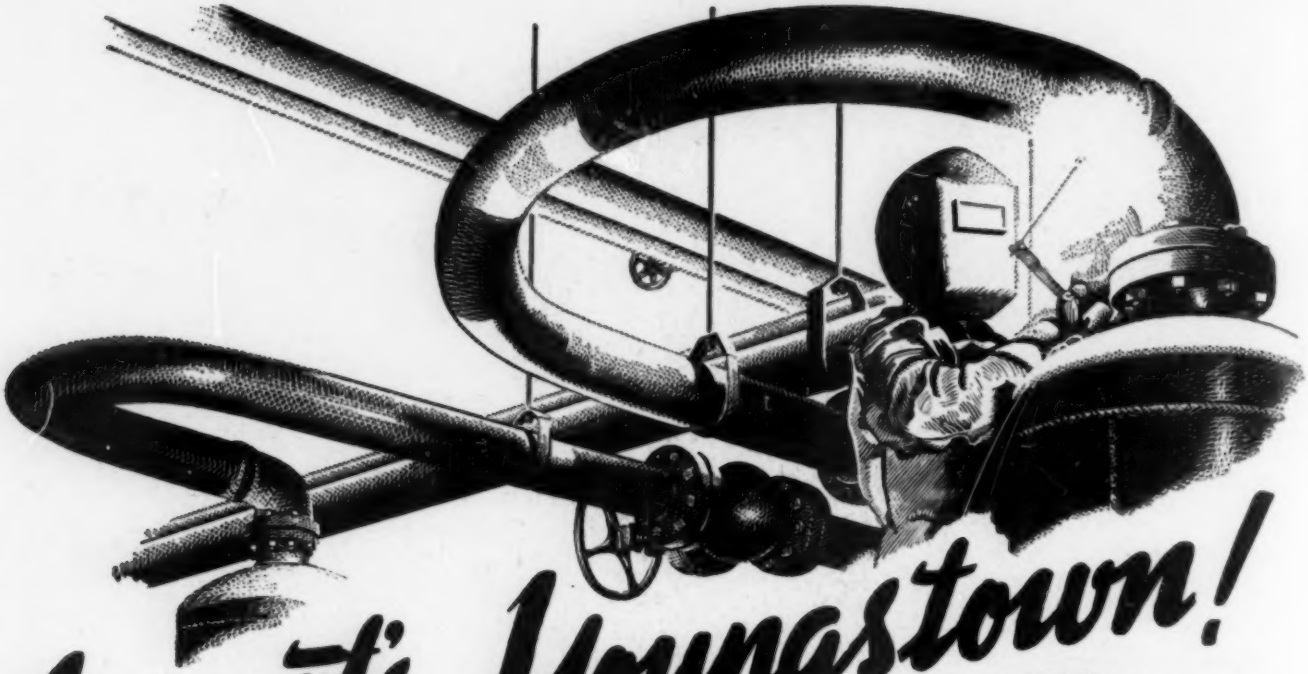
What does this mean to you? Well, if you want to install products that are nationally known for high quality and peak performance—products which insure customer satisfaction and more business for you—install American Blower Equipment . . . the standard of the world since 1881! Consult the nearest American Blower Branch Office for data.

Utility Set with enclosed motor and V-Belt drive.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

AMERICAN BLOWER



Yes, it's Youngstown!

Dependable Steel Pipe ...Easy to Install

THROUGH the years, the guiding principle at Youngstown has been to make quality steel pipe which is well suited to serve the needs of plumbing and heating contractors and their customers. That's why Youngstown Pipe bends accurately, cuts readily, threads surely, welds easily--properties designed into the product for efficient fabrication, installation and long, satisfactory service.

Youngstown
STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices - Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES.

QUICK RESPONSE.....

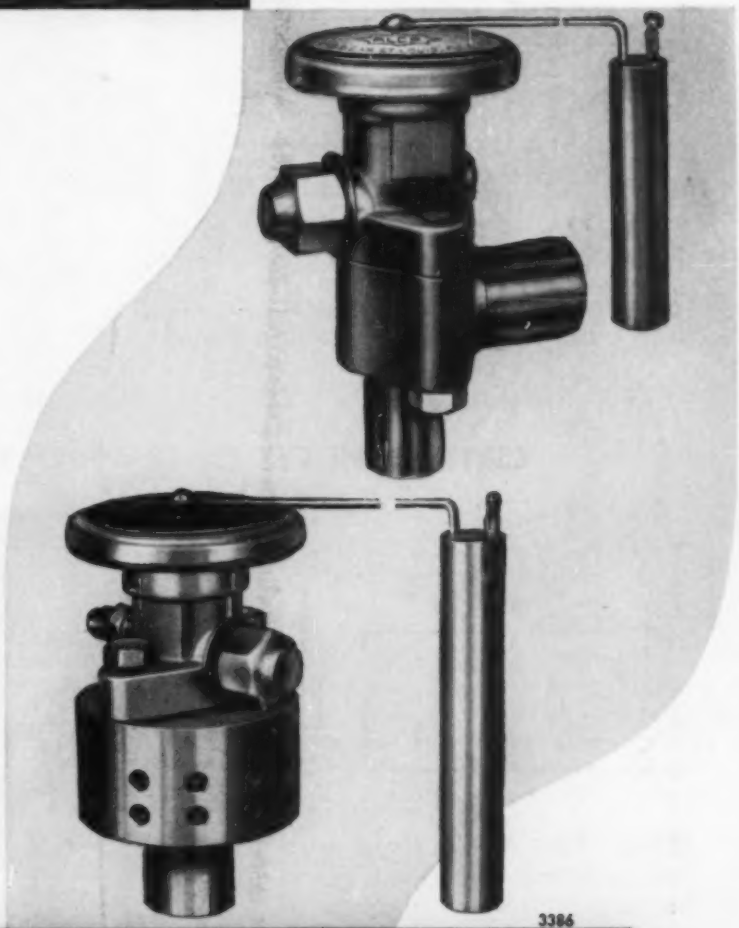
the precision-throttling action of ALCO THERMO VALVES

Alert Alco Thermo Valves get better results from refrigeration systems by controlling the refrigerant flow more accurately and dependably. Reasons:

- **Minimum moving parts mean less friction and wear, quicker response to slight changes in superheat**
- **Cupped diaphragm has no welds in flexing area — prevents loss of thermal charge**
- **Rugged, corrosion-proof internal parts, precision-built for easy interchangeability**

Capacities: ¼ to 50 tons, "Freon-12"; ½ to 100 tons, methyl chloride. Choice of 2 to 36 outlets in multi-outlet models.

Available from your nearest Alco wholesaler. Ask for Bulletins 171 (single outlet) and 180 (multi-outlet).



3386

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

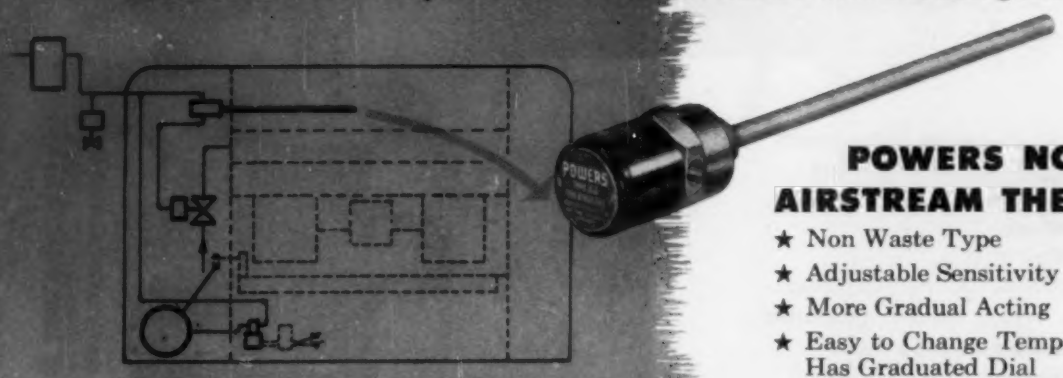
Whether Ventilation is by Central or Unit System...

POWERS

GIVES EXTRA FEATURES

—where it is important!

UNIT VENTILATOR CONTROL—Requires Low Limit Thermostat with advantages listed below—

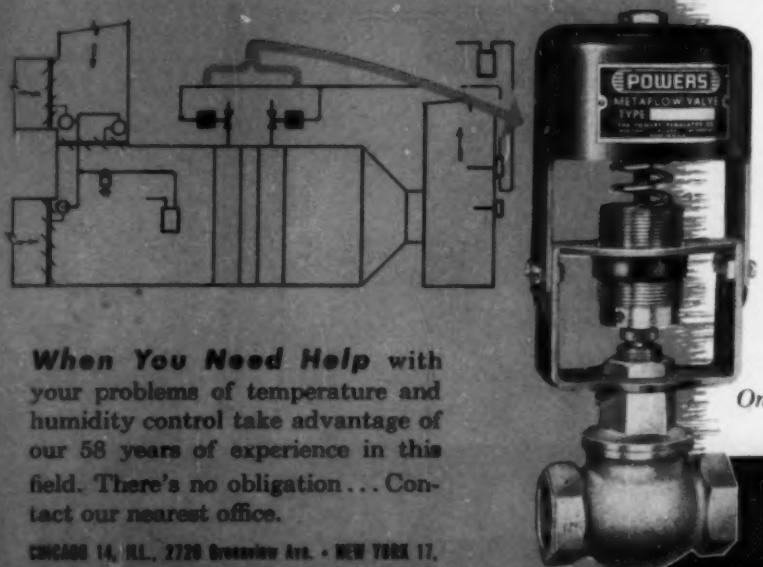


Unit Ventilators operate on low limit thermostat a large portion of the time.

POWERS NO. 356 AIRSTREAM THERMOSTAT

- ★ Non Waste Type
- ★ Adjustable Sensitivity
- ★ More Gradual Acting
- ★ Easy to Change Temperature Setting Has Graduated Dial
- ★ No Restriction Valve to Set

CENTRAL FAN SYSTEM CONTROL—Requires Proper Valves



POWERS METAFLOW VALVE

- ★ Low Hysteresis
- ★ Large Power Factor—opposed by heavy spring for smoother operation
- ★ Exposed Adjustable Spring to Insure Proper Sequence Operation
- ★ Exposed Valve Stem Packing Adjustment
- ★ Valve Stem Lubricator Optional

Only one of the many types of POWERS valves.

When You Need Help with your problems of temperature and humidity control take advantage of our 58 years of experience in this field. There's no obligation... Contact our nearest office.

CHICAGO 14, ILL., 2720 Greenview Ave. • NEW YORK 17, N. Y., 231 East 46th Street • LOS ANGELES 5, CAL., 1808 West Eighth Street • TORONTO, ONT., 105 Spadina Ave.

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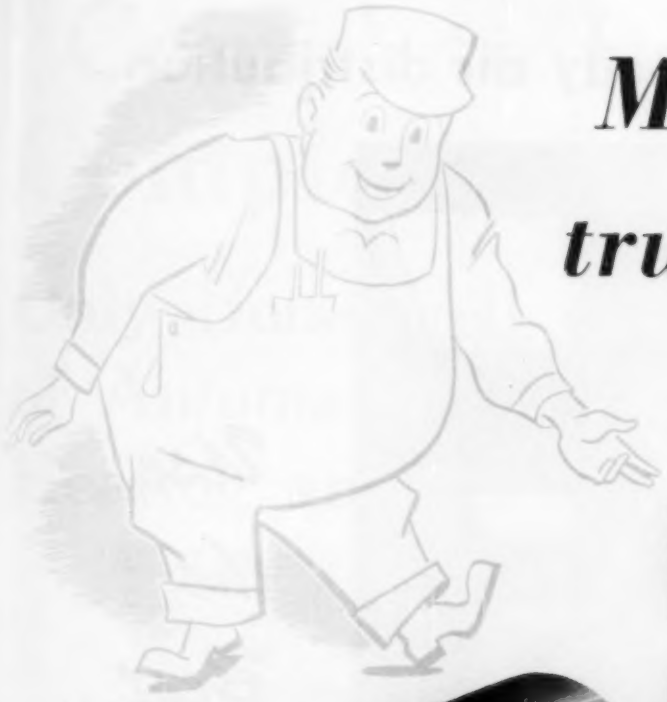

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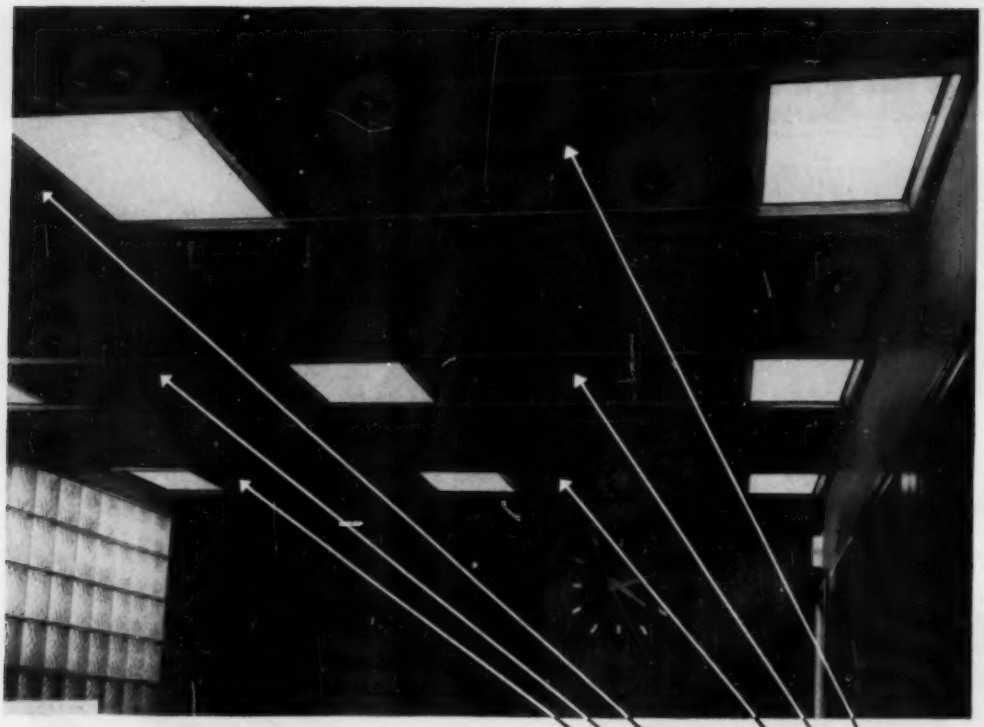
For *complaint-free* low velocity air distribution



THE CARRIER CORPORATION OFFICES, New York City. Multi-Vent panels, barely discernible in beautiful, plaque-type coffered ceiling. Remarkably fine temperature regulation achieved by varying air volume in each zone with thermostat controlled modulating dampers.

Use the Best...

Use

MULTI-VENT *Ceiling Panels*

T.M. Reg. U.S. Pat. Off.

Though the cost of supply and return air outlets is a very small percentage of the overall cost of a good air conditioning system, economizing in the selection of air distribution media is often the cause of complaints from clients on drafts, uneven temperatures, insufficient air, noise and dirty ceilings.

Multi-Vent is better able than any other diffuser to provide widespread uniform air distribution, without these common objectionable conditions because the basic draft, noise and dirt hazards, inherent in all other diffusers, are non-existent in the unique Multi-Vent principle of *distributing air entirely by displacement rather than by high velocity injection.*

In distribution by displacement there are *no* strong air streams to aim and *no* change in air flow pattern when air supply is varied. Regardless of room size, ceiling heights and relative positions of partitions, beams, etc., *all problems of outlet location and air direction adjustments for throw and drop to avoid drafts are eliminated.*

Multi-Vent, moreover, can handle greater amounts of air in proportion to room size than any other diffuser and still maintain a rate of air motion low enough to meet not only the most exacting comfort zone requirements but also to solve the high load and high ventilating problems in critical laboratory and industrial processing areas.

Multi-Vent has many other advantages such as savings in basic heating, cooling and air handling equipment in addition to the important installation, maintenance and decorating economies.

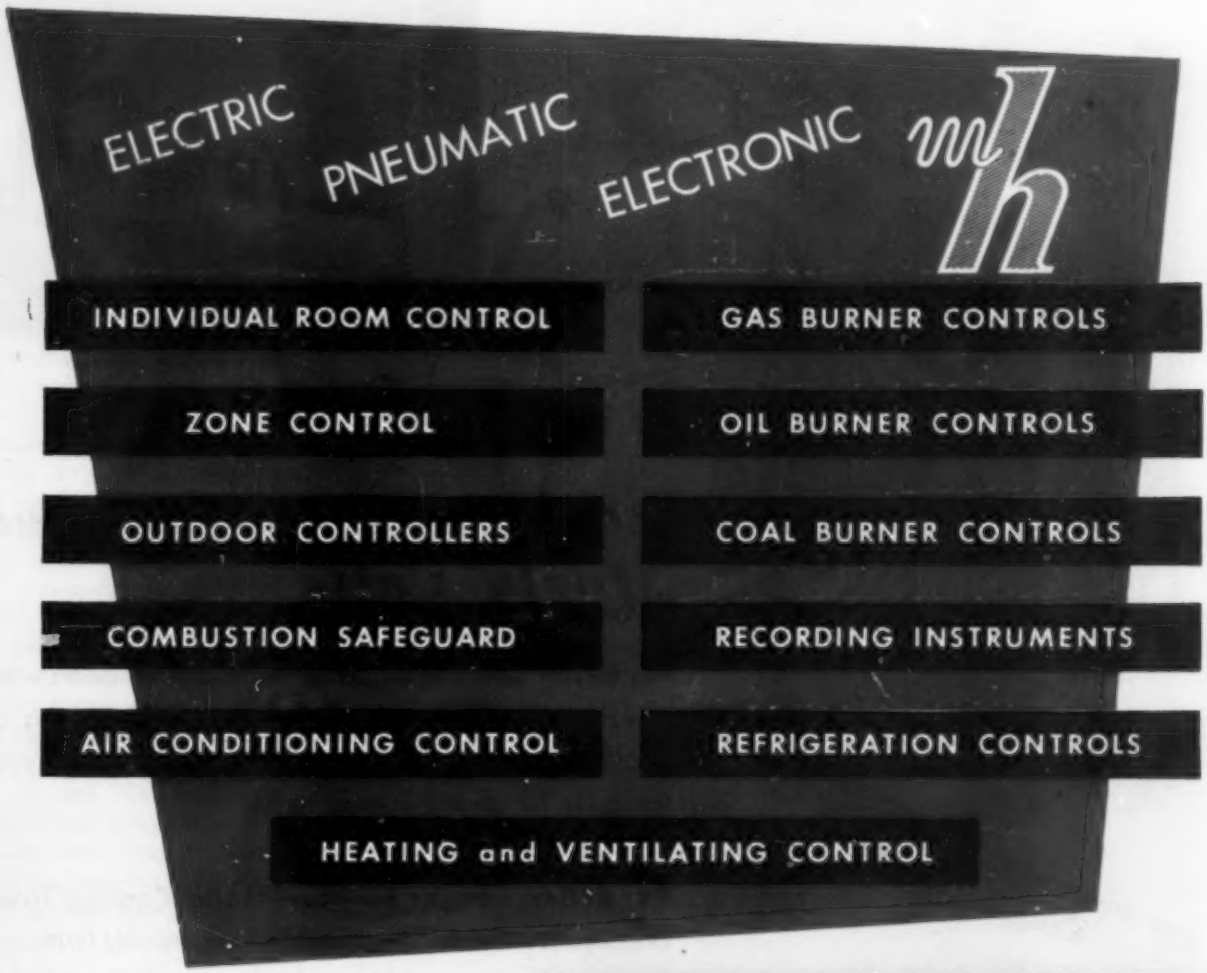
Write for detailed literature and the name of our sales engineer in your vicinity.

MULTI-VENT DIVISION • THE PYLE-NATIONAL COMPANY 1373 N. KOSTNER AVE., CHICAGO 51, ILL.

YOUR ENTIRE AIR CONDITIONING SYSTEM WILL BE JUDGED BY THE PERFORMANCE OF THE OUTLETS

Complete Line..... Complete Responsibility!

Only Honeywell Gives You Every Type of Automatic Control for Every Heating and Air Conditioning Need



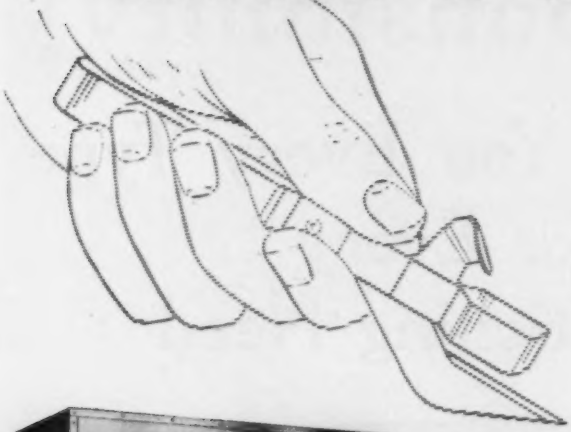
ONLY Honeywell offers a line of controls that's *complete*, for every type of installation in any building, new or old, large or small. So standardize on Honeywell. Gain the two-fold assurance only Honeywell can offer —undivided responsibility for all controls on the job, plus recommendations free from all prejudice. Put your confidence where you know it can be supported. Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Leaside, Toronto 17, Ontario.

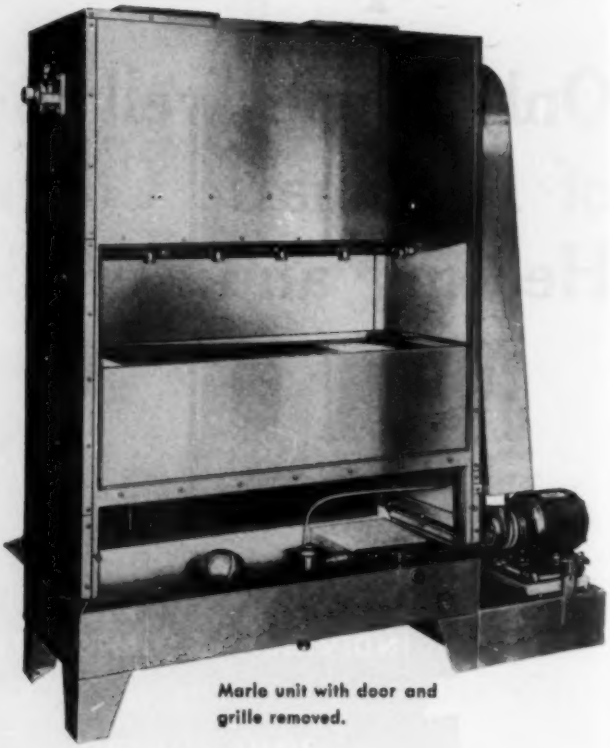
MINNEAPOLIS **Honeywell**

CONTROL SYSTEMS

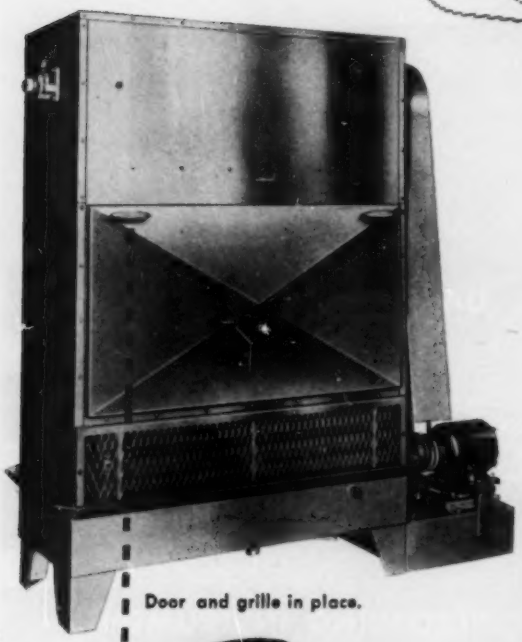
77 BRANCHES FROM COAST TO COAST WITH SUBSIDIARY COMPANIES IN: TORONTO • LONDON • STOCKHOLM • AMSTERDAM • BRUSSELS • ZURICH • MEXICO CITY

Accessible with handles... instead of a can opener

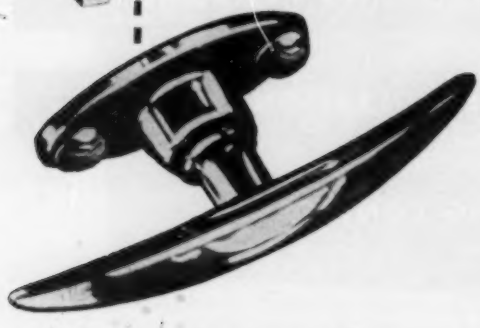




Marlo unit with door and grille removed.



Door and grille in place.



Corrosion-proof solid bronze door type handles used on Marlo equipment.

Efficiently Engineered Marlo Units

...**For Easier *Servicing***—Conveniently placed doors with bronze handles give immediate access to all working parts of Marlo Cooling Towers and Evaporative Condensers. Two screws free the grille for cleaning sump tanks.

...**For Better, Longer *Service***—Marlo Cooling Towers and Evaporative Condensers operate *economically* (with up to 95% water savings)... *quickly*—with no roar of fan blades... and their exclusive "Lektro-Tektor" sump tank unit guards against electrolytic corrosion... all design features by Marlo that mean more dependable, economical operation for your customers!

Write for infomation on the complete Marlo line.

MARLO HEAT TRANSFER
Since 1925

COIL CO. • 6135 Manchester Rd. • St. Louis 10, Mo.

"Taylor Forge has thought of everything!"

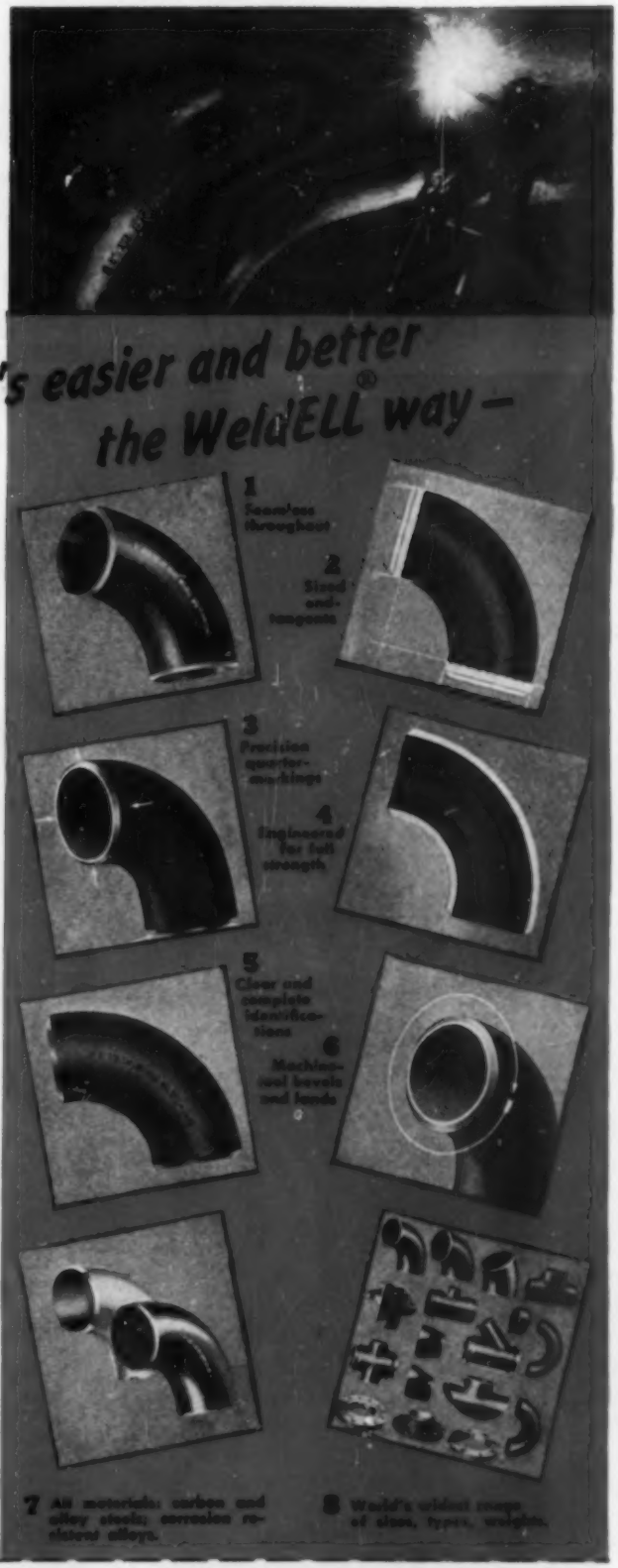
A construction superintendent said it, but it has been expressed in one way or another by thousands of men who have lived and worked with Taylor Forge Welding Fittings and compared them with all other makes.

From the very start, Taylor Forge did the improving: set up a rigid, seemingly unattainable set of specifications for ideal welding fittings long before they were produced on a commercial scale.

But it was easier to think of everything than to accomplish it. Only the knowledge that Taylor Forge had accumulated, only the forging skills that Taylor Forge had developed, could have produced welding fittings that please alike the men who design piping, the men who erect piping, and the men who pay the bills.

Today in the WeldELL line, you have the fittings that *ask* for comparison. Some of their plus-value features—features that are combined in no other fittings—are pointed out here. Remember that the plus-value line is also the broadest line! Coupon brings catalog.

Taylor Spiral-Weld Pipe is again promptly available in a broad range of sizes and thicknesses. Coupon brings new Spiral Pipe Bulletin 493.



TAYLOR FORGE TF

TAYLOR FORGE & PIPE WORKS P. O. Box 485, Chicago 90, Ill. • Eastern Plant: Carnegie, Pa. • Western Plant: Fontana, Calif. • District Offices: New York, Philadelphia, Pittsburgh, Houston, Los Angeles, Chicago.

☐ Please send new Catalog 484 covering welding fittings and forged steel flanges.

☐ Send new Bulletin 493 covering Taylor Spiral-Weld Pipe and related fittings.

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Nothing heats better than Modine Convector Radiation . . . NOTHING LOOKS MORE BEAUTIFUL IN A BEAUTIFUL ROOM

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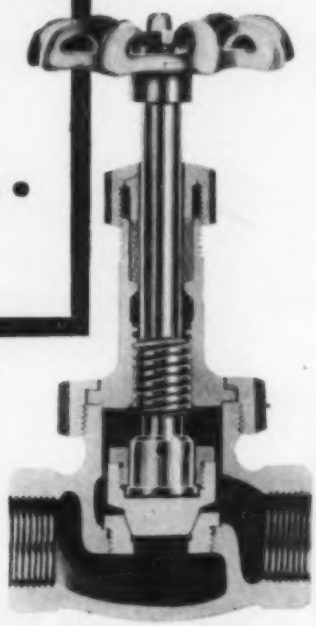
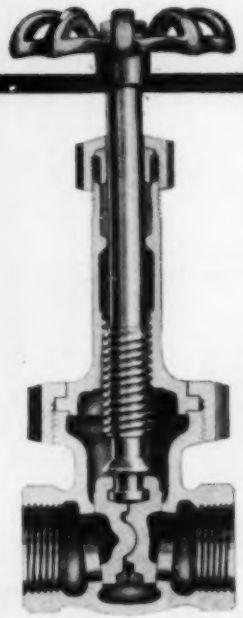
R-1045

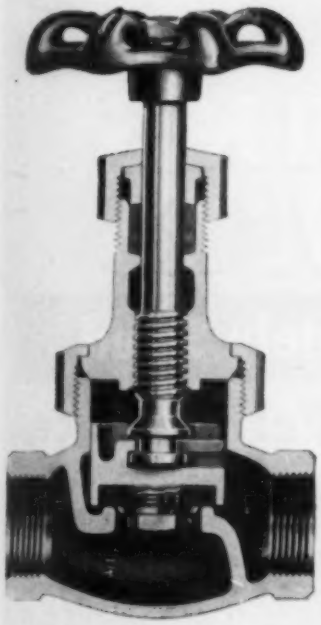
Walworth bronze valves...



Walworth No. 225P Globe Valve
500 Brinell Seat and Disc



Walworth
No. 29 Gate Valve



Walworth No. 95 Globe Valve
Re-New-Disc

built to give dependable trouble-free service on all recommended jobs

Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development—saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

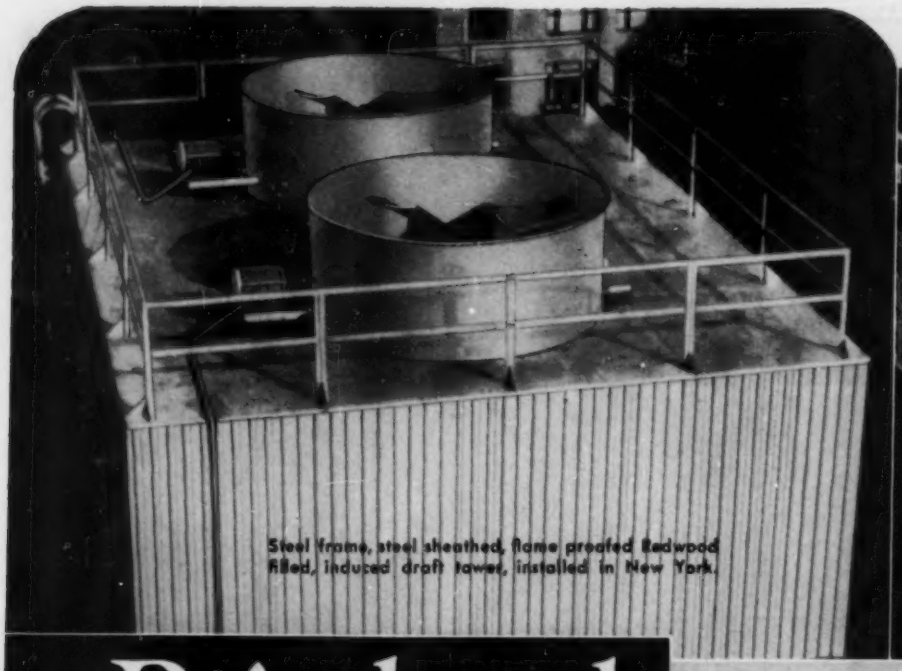
Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bonnets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

Walworth No. 225P Bronze Globe Valves (Angle Type: No. 227P) are rated at 350 psi working steam pressure, 550F; and 1000 psi non-shock service on cold water, oil and gas. The stainless steel, plug type seat and disc — heat treated to 500 Brinell — can be closed on sand, slag, scale and similar floatage, without injury to the seating surfaces. They are the longest wearing, TOUGHEST bronze valves you can buy.

For full information about Walworth Quality Bronze Valves, see your Walworth distributor, or write:

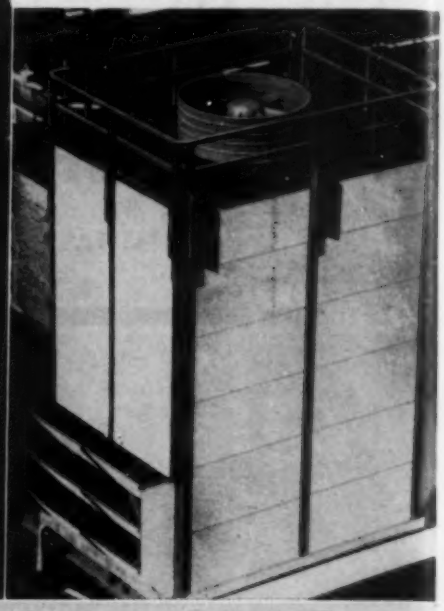
WALWORTH
valves and fittings
60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



Steel frame, steel sheathed, flame proofed Redwood filled, induced draft tower, installed in New York.

Redwood frame, Transite sheathed, high capacity, counter-flow design, installed in Kansas City.

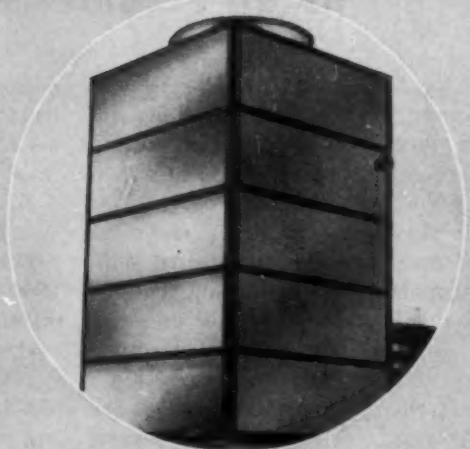


Pritchard COOLING TOWERS

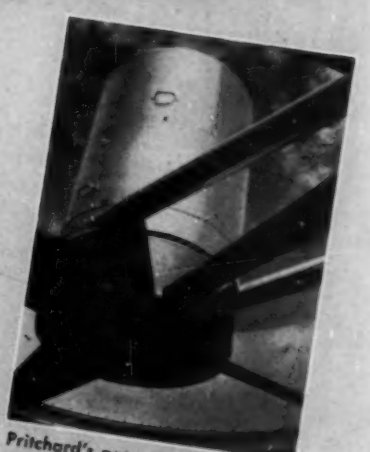
Thoroughly Engineered* Adequately Sized

*For Longer Life and Trouble-Free Performance

Standard Redwood spray type towers of any size, available from our stock.



Series Q, typical fire-code design for air conditioning installations. This design is known as the Pritchard FIRETITE.



Pritchard's patented SEALDFLOW unitized, self-ventilating fan drive, available on new towers or as replacement units on any make of tower.

THREE LEADING LINES
Cooling Towers
Heat Exchangers
Gas Equipment for
FIVE MAJOR FIELDS
Chemical, Natural Gas, Petroleum, Power and Refrigeration.

EQUIPMENT DIVISION
908 Grand Ave. Kansas City 6, Mo.

J.F. Pritchard & Co.
ENGINEERS • CONSTRUCTORS • MANUFACTURERS
for the CHEMICAL, PETROLEUM, GAS & POWER industries

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BRUNNER SINCE 1906 **REFRIGERATION** helps you serve better

...a size and type for every purpose

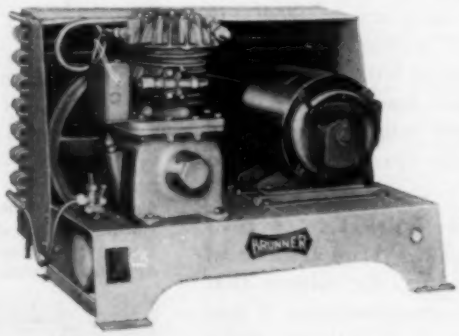
STANDARDIZE on Brunner Condensing Units. Strengthen your sales and service advantages by having available *customer accepted* units in sizes and types fitted to every refrigeration job.

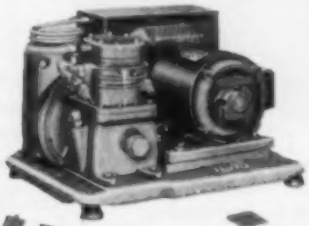
Equipment manufacturers, air conditioning engineers and contractors, general refrigeration engineers and service companies can profit more when backed by a source of supply with ample, self-controlled production facilities.

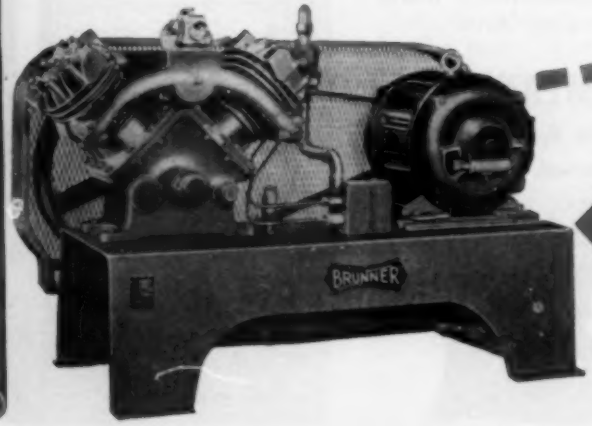
Brunner Condensing Units are continuously advertised to the "user" trades and industries. They are known by their service records...preferred for their operating efficiency, economy and long life.

BRUNNER MANUFACTURING CO.
Utica 1, New York, U. S. A.

● 22 Brunner branch office representatives who really know refrigeration are available whenever you say the word. We sincerely believe a meeting with one of these men would prove useful and well worth your time.







REFRIGERATION CONDENSING UNITS
...a size and type for every purpose

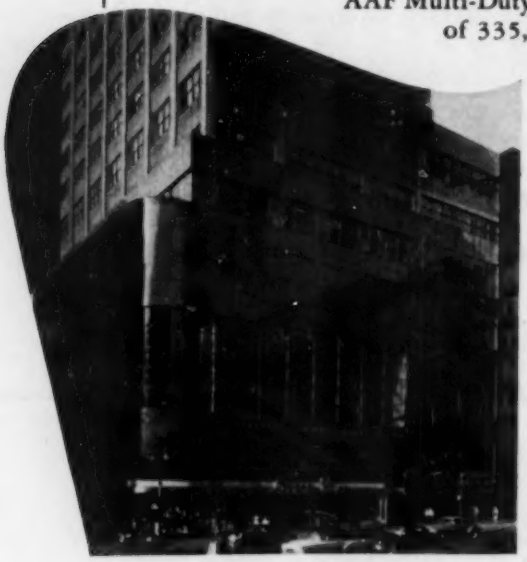
BRUNNER SINCE 1906

AIR AND WATER COOLED MODELS
¼ HP. TO 30 HP.

What is the life of an Air Filter?

AAF Multi-Duty Celebrates 20th Birthday at Philadelphia Savings Fund Society

AGE has only added stature to this famous Philadelphia building. Although erected 20 years ago this structure, because of its many advanced design and construction features, could well pass for a youngster among post-war buildings.



Howe & Lescaze, ARCHITECTS
H. B. Hackett, ENGINEER
Carrier Corp., AIR CONDITIONING
Riggs Distler, MECHANICAL CONTRACTOR

AAF Multi-Duty air filters with a total capacity of 335,000 C.F.M. were a part of the original air conditioning installation. These "veterans" are still on the job and require only normal periodic maintenance.

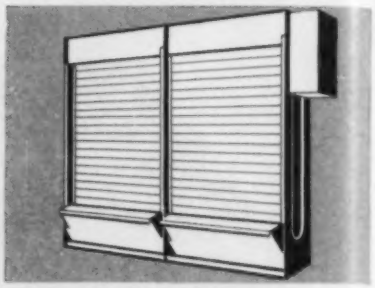
Birthdays such as this are not uncommon for American Air Filter equipment—and they prove two important points: One—it's the final cost which justifies the careful engineering and quality construction that goes into every AAF air filter. Two—to get the maximum life from such filters, normal maintenance procedures must be practiced regularly year in and year out.

The Multi-Duty is only one of a complete line of American Air filters that are designed and built for long and exacting service. If you pride yourself on efficient, long-lived installations, make certain that the air filters carry the insignia of "AAF".

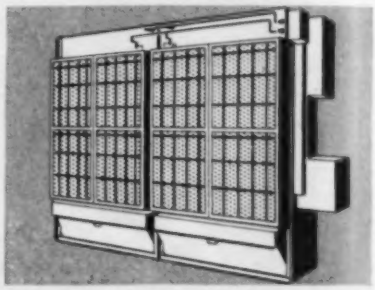
AMERICAN AIR FILTER COMPANY, INC.
373 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF
AIR FILTERS
AND ELECTRONIC PRECIPITATORS

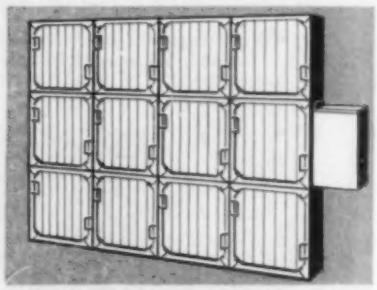
THE COMPLETE "QUALITY" LINE



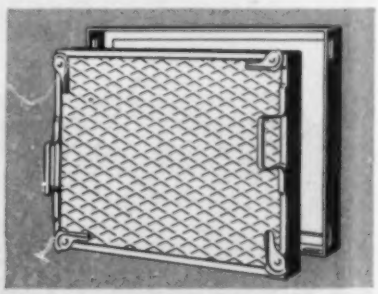
MULTI-DUTY automatic viscous filters have provided super-clean air for Philadelphia Savings Fund Society for 20 years.



ELECTRO-MATIC, the automatic electronic precipitator in which the self-cleaning feature simplifies maintenance.

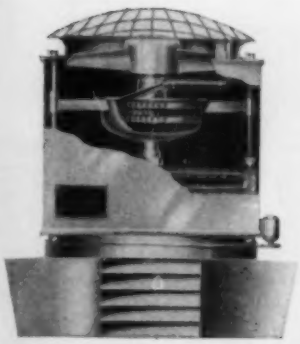


ELECTRO-PL, the dry-type electronic air filter in which the collector element is electrostatically charged Airmat paper. Combines mechanical filtration with electronic air cleaning.



Type M/W viscous unit filter. Designed for heavy-duty industrial service.

Remember—Only AAF offers "Selective Air Filtration" —the right filter for every job



The New Wing Turbine Revolving Unit Heater

This new product of L. J. Wing Mfg. Co. is the logical result of constant improvements in two specialized lines of equipment pioneered by this company.

The first Wing turbine was built as an integral part of the Wing forced draft blower 40 years ago. The first lightweight ceiling-suspended downward discharge unit heater was introduced by Wing 25 years ago.

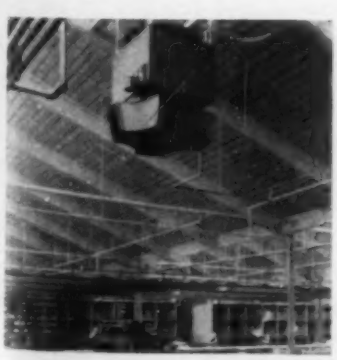
With the addition of the patented revolving discharge outlet in 1935 the next major step in the Wing program of constant improvements is the Wing Turbine Driven Revolving Unit Heater now offered.

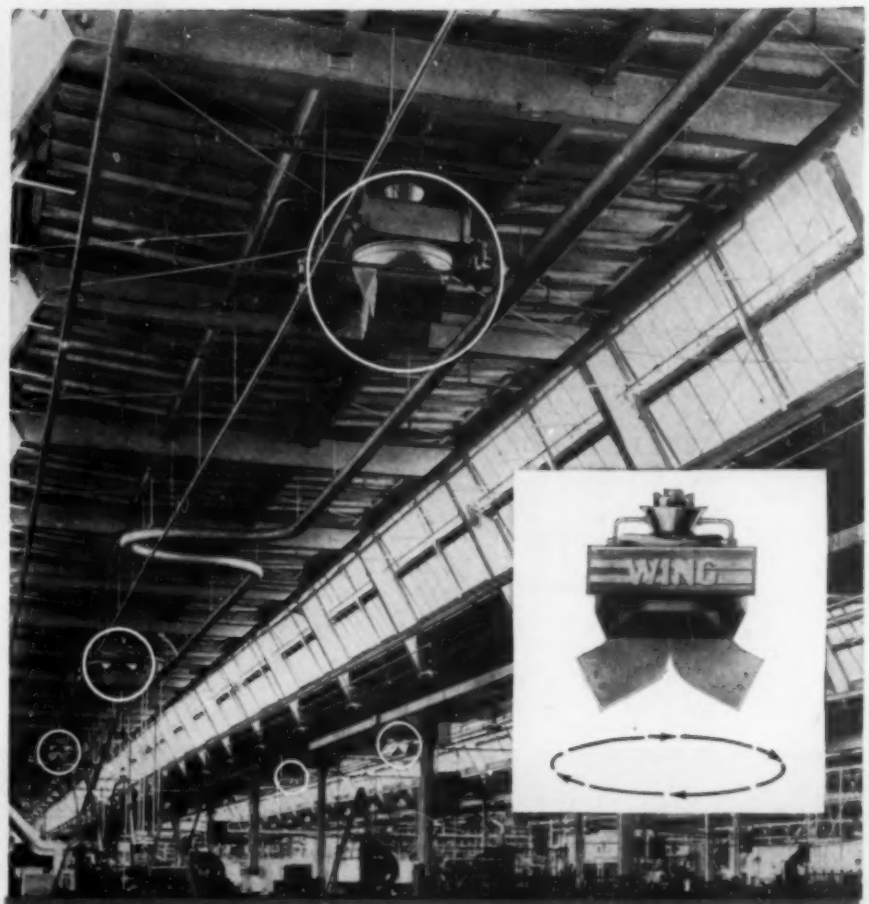
In this, the fan is driven by the new Wing Allsteel Steam Turbine operating at any pressure, and the turbine exhaust is piped into the heater section. Thus the steam condensed in heating the air has first been used to operate the fan turbine.

Electric motor and electric power are eliminated.

Condensate from the heater is never at a temperature exceeding 170° F. even with air inlet temperatures as high as 100° F. Condensate is returned to the boiler through an open return system.

The entire unit is so designed that there is no back pressure on the turbine, assuring against leaks without the use of power-absorbing, troublesome packing. This also eliminates the need for traps and extra piping.





Only Revolving Discharges Can Thoroughly Circulate Heated Air

Industrial plant heating reaches its highest peak of perfection in the Wing Revolving Discharge Unit Heater. Unlike stationary discharge unit heaters, which project heated air in one or more fixed directions, the Wing Revolving Discharge outlets move slowly through a complete arc, flooding the entire heating area with a blanket of fresh, live warmth. The gentle air motion caused by the constantly changing directions of the heated air from the revolving discharge outlets eliminates the hot blasts and chilly areas common with stationary discharge type unit heaters—creates a refreshing, stimulating atmosphere beneficial to employee morale and productivity.

Successful applications of Wing Revolving Heaters have been made in every type of industrial plant, as well as other buildings with unique heating problems. Get complete information on this modern form of unit heating by writing today for a copy of Wing Bulletin HR-5.

L. J. Wing Mfg. Co. 14th Street & 7th Avenue, New York 11, N. Y.

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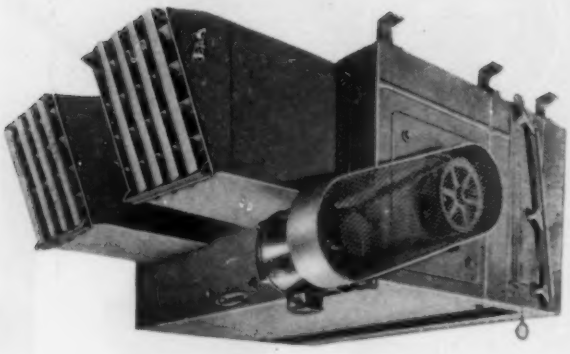
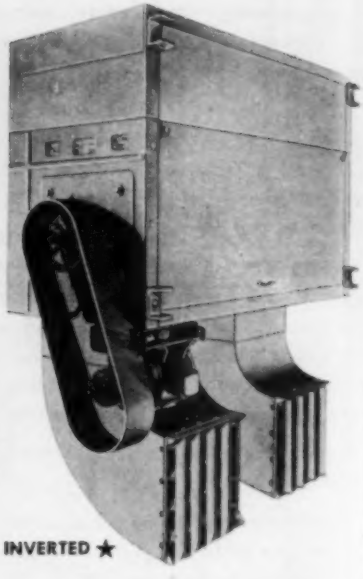
Revolving UNIT HEATERS

★ HORIZONTAL



★ FLOOR MOUNTED

These big space heaters are big fuel savers



INVERTED ★

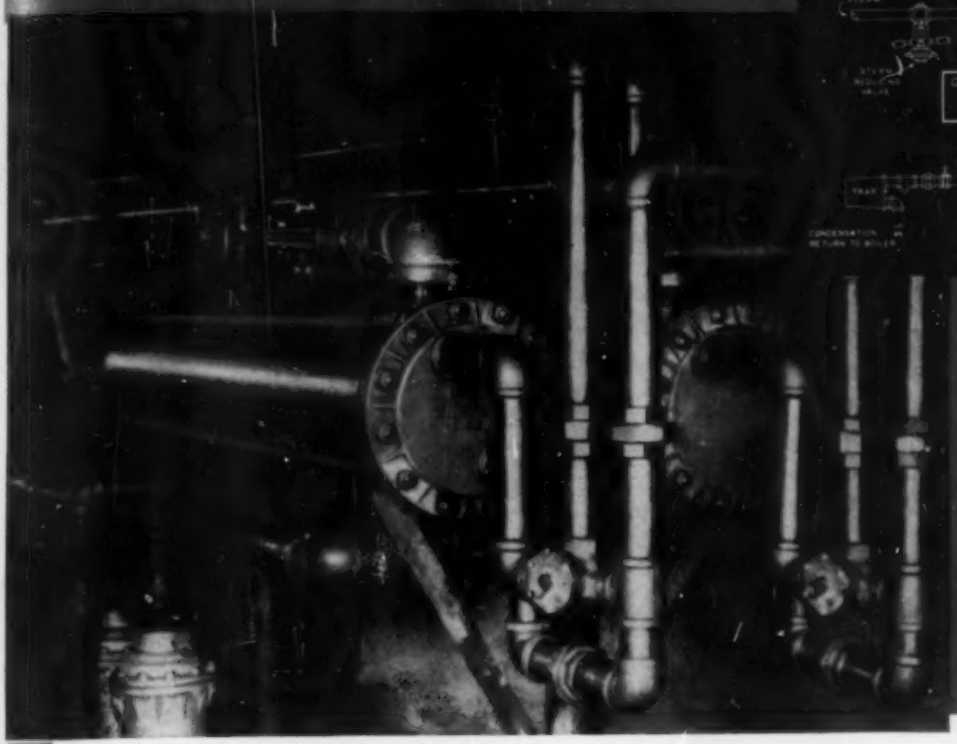
For providing low-cost heat to every corner of large, enclosed areas, Carrier Heat Diffusers have no superior. They supply it evenly under all conditions at full or partial loads, and their advance design keeps fuel costs at a minimum. That's why more and more of them are being installed in factories, warehouses, garages and other industrial-type buildings throughout the country.

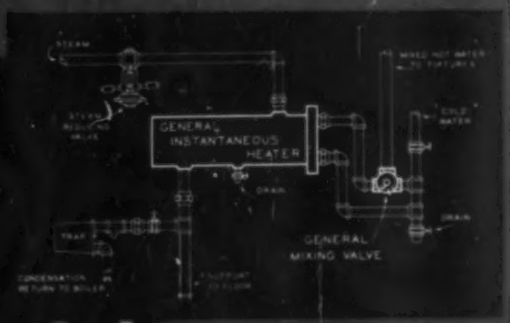
These standard units control heat flow either by Carrier non-freeze steam-distributing tube coils and modulating valves — or by Carrier Thermadjust by-pass with modulating electric control at full steam pressure. Adaptable to drying and ventilating as well as heating, they come in a wide range of capacities . . . *and do not need duct work.* In fact, they are shipped as a complete assembly, ready to operate. Louvers are adjustable, and sectional design facilitates floor mounting or suspension with vertical or horizontal discharge.

Three Carrier Heat Diffusers are shown here. They represent the last word in Carrier design and engineering skill, developed through years of experience and research in air conditioning, refrigeration and industrial heating. Like all products in the Carrier line, they are built to give long years of economical service. Carrier Corporation, Syracuse, N. Y.

Carrier AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

Here's what modernizing can do for your source of hot water!



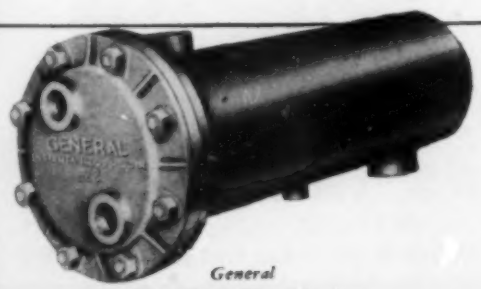


Two #628 General Instantaneous Water Heaters connected in parallel provide hot water for complete laundry facilities of a prominent New England Institution with 1100 patients. Capacity: 74 gallons per minute raised from 40° to 170° with steam supplied at 40 lbs. pressure.

BIG SUPPLY in LOCKER-SIZE SPACE

IF YOU NEED more hot water or more space in your boiler room . . . if you want to avoid heavy installation costs and the confusion of extensive construction, here's the hot water system to install. It has no tank . . . requires no excavation, no complicated piping. Occupies a minimum amount of space. The largest of 17 different sized units measures less than 15" by 120". And you can get up to 270 gallons of continuous hot water a minute . . . all with a *General Instantaneous Water Heater.*

For complete new hot water systems, booster systems or spot systems located throughout your plant, General Instantaneous Water Heaters are unexcelled. They save space—save heat—save money. The General is heated with live steam up to 125 lbs. through the shell—or with exhaust steam or boiler water. Include General Water Heaters in your modernizing plans. Get complete details in Catalog 18. General Fittings Co., Dept. A, 123 Georgia Ave., Providence 5, R. I.

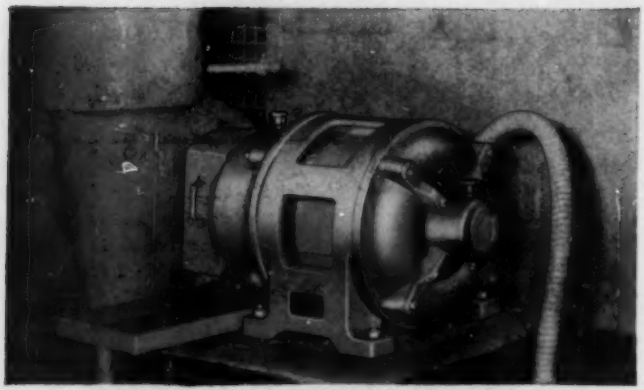


General Instantaneous Water Heaters 17 Sizes up to 270 G.P.M.

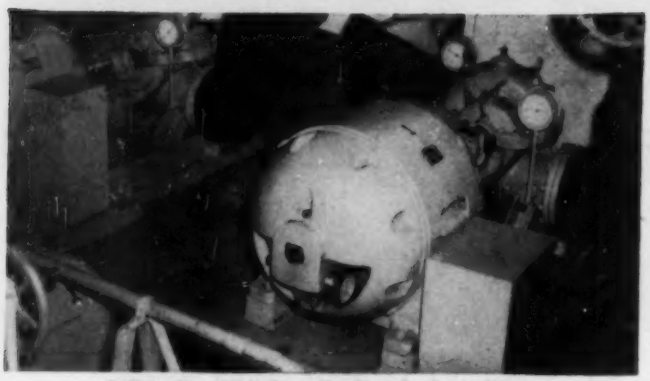
GENERAL

TANKLESS AND INDIRECT WATER HEATERS AND HEATING SPECIALTIES

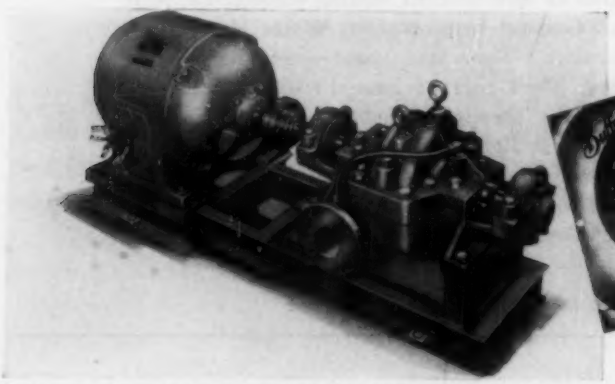
Haven't had a minute's trouble since we put in "Buffalo" Pumps



Buffalo Close-Coupled Pump On Chilled Water Service



Buffalo Class "SL" Pump Handling Condenser Water



Buffalo Class "RR" Pumps For Boiler Feed and Other Clear Water Service

—AND THAT, PLUS EFFICIENCY, MEANS REAL ECONOMY IN CLEAR WATER PUMPING

Ask any user of clear water pumps—the pump you can "forget about" is the one that's saving you money! And from on-the-job reports of "Buffalo" Pumps, we know that they are piling up savings for users, both in maintenance and power consumption. That's because all "Buffalo" Pumps are built ruggedly—and because they're built for efficiency—impellers and water passages designed to handle maximum water with minimum resistance.

Best of all, in the "Buffalo" line, you can match the pump to *your* service and *your* conditions. For boiler feed, for air conditioning applications—for almost any pressure and capacity—there's a "Buffalo" Pump ready to give you worry-free service—and each one passes a thorough load test under your specified conditions before shipment.

WRITE for your free copies of these bulletins! No. 955-N gives engineering facts on "Buffalo" Type "SL" Pumps; No. 960-B on Type "RR" Pumps; and No. 975-B, on "Buffalo" Close-Coupled Pumps.

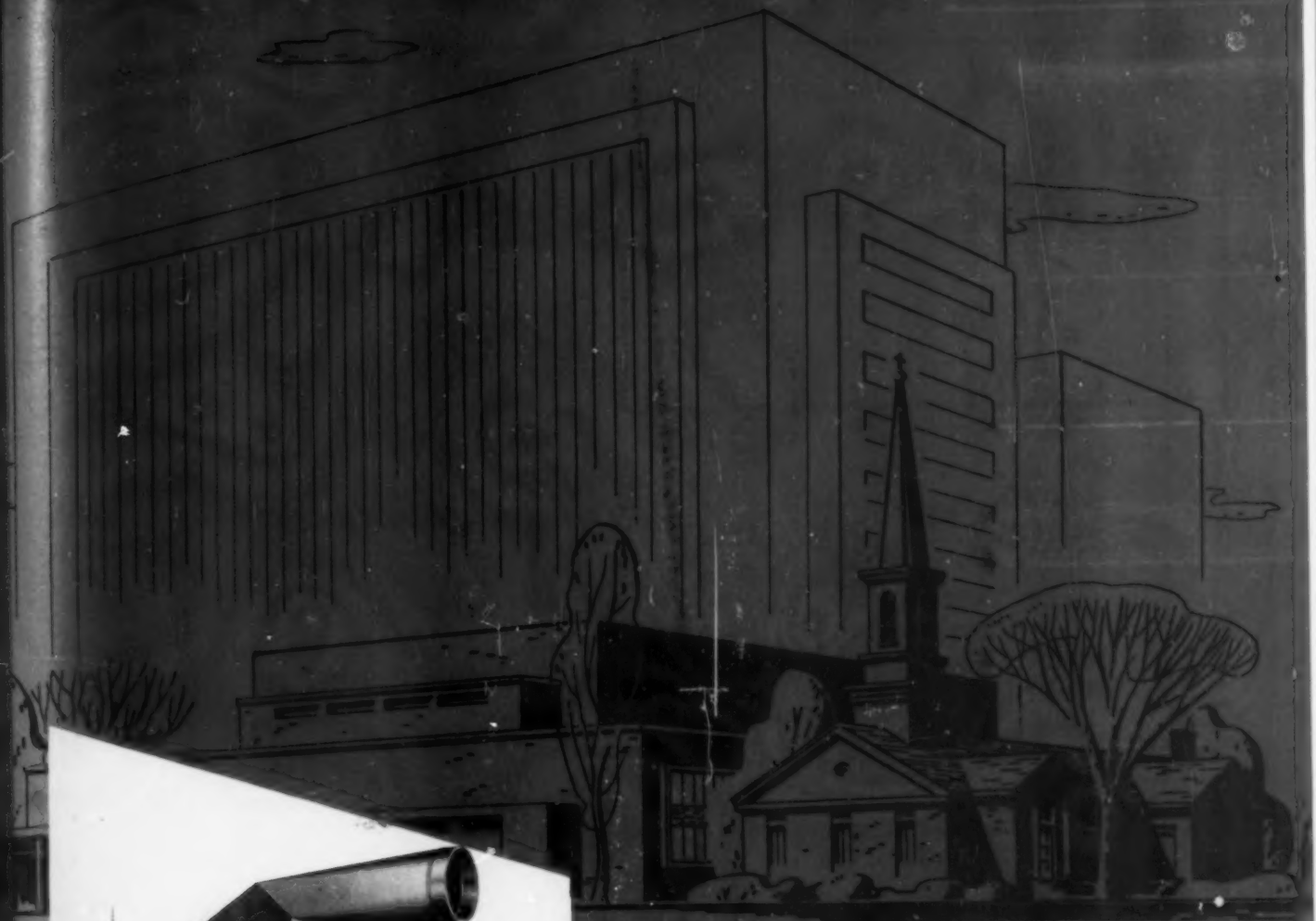
"Buffalo" PUMPS

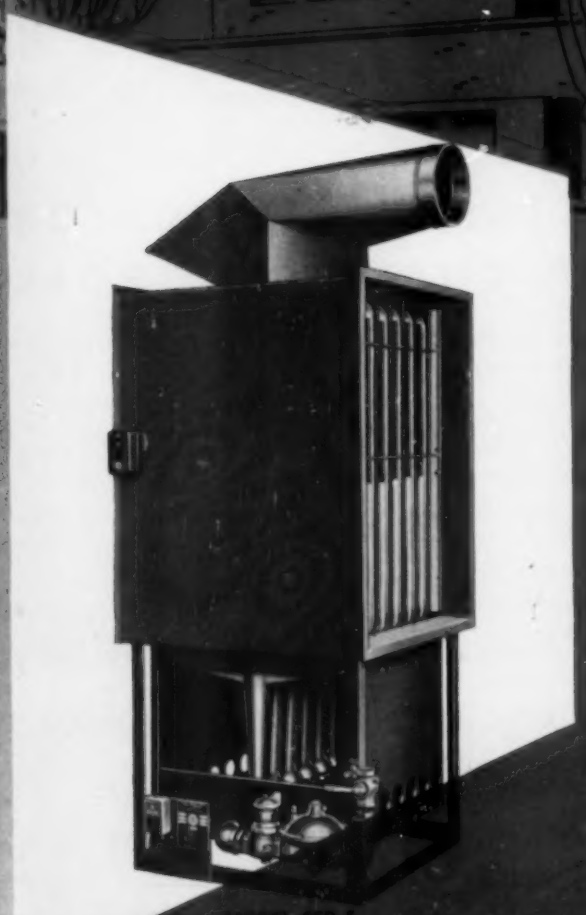
BUFFALO PUMPS INC.

171 MORTIMER STREET BUFFALO, NEW YORK

Canada Pumps Ltd., Kitchener, Ont.—Branch Offices in All Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID





MODEL SFD-5

HAYES DUCT FURNACE SETS A NEW HIGH STANDARD FOR QUALITY . . .

1. Designed to be used as a direct fired heat exchanger for Industrial-Commercial and Air-Conditioning systems.
2. Requires less floor space than any other direct fired unit of comparable capacity.
3. Stabilized stainless steel heat exchanger and all-welded construction insure long life.
4. Manufactured in 14 sizes to accommodate accurate BTU requirements.
5. Light weight compact design, saves space, labor, and shipping costs.
6. No need to protect heat exchanger with dampers when installed down stream of cooling coils, nor when condensation is probable.

For complete information and specifications write your nearest dealer or

HAYES FURNACE MFG. & SUPPLY CO.
2929 South Fairfax Ave., Los Angeles 16, Calif.

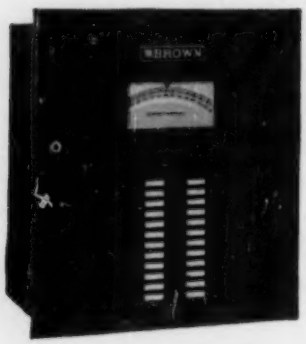
HAYES DUCT FURNACE

BOYD WATER-HEATING CO., 122 W. Gromke, Albuquerque, New Mexico • BUNBOLD & CO., 379 Nelson Street, Atlanta, Georgia • RODGERS-BARBECK CO., 3031 Cedar Springs, Dallas, Texas • HARRY HERMAN, 1220 California Street, Denver, Colorado • BOYD ENGINEERING CO., 715 No. Stanton St., El Paso, Texas • W. L. LASHLEY CO., 840 Pacific St., Houston, Texas • SMITH STEAM SPECIALTY CO., 2116 Temple Bldg., Kansas City, Missouri • J. C. LEWIS, Pyramid Building, Little Rock, Arkansas • J. M. O'CONNOR CO., 1653 N. W. 5th, Oklahoma City, Oklahoma • MOOLLY-HIGGS, 44 W. Eighth South St., Salt Lake City, Utah • D. R. RIPPEY, 801 Frost Bank Building, San Antonio, Texas • GRIFF SCOTT, 57 Post Street, San Francisco, Calif. • J. M. O'CONNOR CO., 1438 E. 11th, Tulsa, Oklahoma • J. M. O'CONNOR CO., 208 N. Wood Ave., Wichita, Kansas.

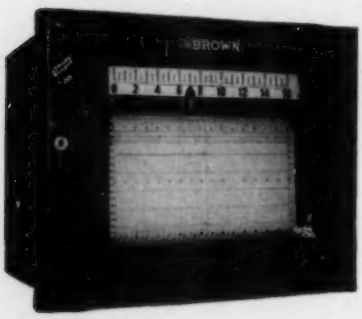
BOYD ENGINEERING CO., 18 South Third St., Phoenix, Arizona

Have a Crystal Ball...

for temperature and humidity conditions **in any section of your plant**



ElectroniK PRECISION INDICATOR STRIP-CHART RECORDER



Write, today, for your copy of Catalog 15-13, for detailed information on the ElectroniK Potentiometer.

These two instruments give you an accurate check on, and a continuous record of, temperature and humidity as maintained by your heating and air-conditioning system.

The Precision Indicator tells you at a glance the temperature of the location selected by the button you push. Wet and dry bulb temperature reading comparisons provide you with relative humidity conditions. The Strip Chart Recorder affords continuous data on these variables at the several locations to which it is connected.

They are flexible in application . . . work equally well with any type system, installed or planned.

The Brown *ElectroniK* Indicator and the Recorder will aid in improving product quality and uniformity in industrial processes.

MINNEAPOLIS-HONEYWELL REGULATOR CO.
BROWN INSTRUMENTS DIVISION
4534 Wayne Ave., Philadelphia 44, Pa.
Offices in principal cities of the United States, Canada and throughout the world

MINNEAPOLIS Honeywell *Advanced Instrumentation* FOR HEATING & AIR-CONDITIONING BROWN INSTRUMENTS

Loyalty to its high standards keeps H & H in the lead

● To users of brass and copper coil strip, seamless tubing and tubular parts, nothing is more important than quality, everlasting uniformity, and a constant loyalty to specifications on which every order is based. That is why more and more firms are turning to the H & H Tube and Manufacturing Company for their tubing needs. If you, too, are interested in learning just how truly dependable a brass and copper tubing source can be, write, wire or call us today.

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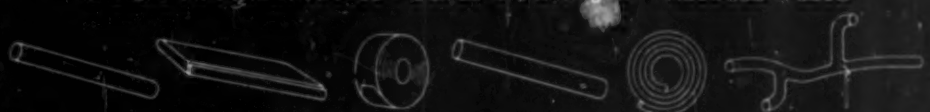

METALFLO · LOCKSEAM · COIL STRIP AND SEAMLESS TUBING · TUBULAR PARTS

WHY fireye

There's only one reason for putting a Flame Failure Safeguard on an oil or gas burner . . . to prevent an explosion . . . to safeguard your entire plant, equipment, and personnel.

Fireye insures complete flame failure protection because it is photoelectric . . . it sees the flame . . . and if the flame fails, Fireye acts with the speed of light to cut off the fuel before dangerous gases accumulate in the combustion chamber.

Controls which do not react instantaneously can not provide full protection . . . for it is the few seconds of delay between flame failure and fuel shutoff which charge the combustion chamber with potential destruction. Nor can devices which depend upon changes in temperature or other secondary flame characteristics be depended upon in an emergency.

Fireye is the outstanding combustion safeguard which meets the exacting requirements of insurance laboratories for the protection of ALL classifications of oil and gas burner installations. Write for bulletin 604-B.

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COMBUSTION CONTROL CORP.

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Wheatland

TUBE COMPANY

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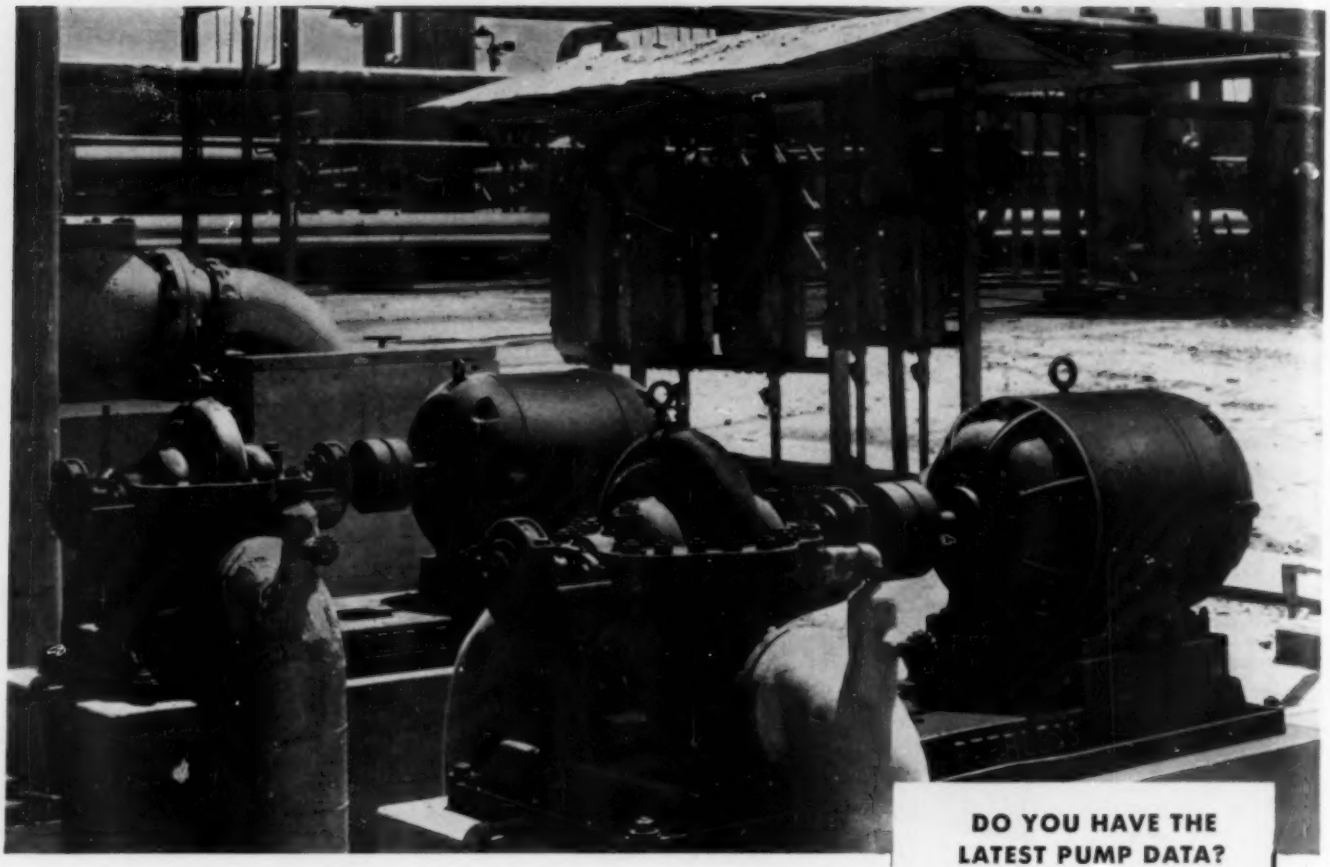
77 BROADWAY, CAMBRIDGE 42, MASS.

WHERE THERE'S A PUMP IN YOUR PLANS



Plan with Peerless Centrifugal Pumps

From plan to plant there's a Peerless horizontal centrifugal pump that meets your needs. For the diversified, continuous duty services of private industries and public projects, Peerless Pumps incorporate many proved advantages in design and construction for extended pump life and operative economy.

All along your flow lines, Peerless can provide pumps incorporating the latest principles of hydraulic practice and experience plus the versatility and efficiency you require for *peerless* pumping performance.

For example, the pumps shown above are single stage, double suction, general purpose Type A pumps, a comprehensive line of Peerless pumps offering a capacity range from 50 to 60,000 gpm. There are scores of other Peerless types, hundreds of other Peerless models for thousands of pumping applications. Peerless furnishes horizontals for handling solids in suspension as well as for clear liquids. There are pumps for boosting, circulating, transferring and filtering. They can handle volatile L-P Gases or tricky acid, basic and salt solutions. They can move liquids at high temperatures or they can provide water (or foam) for *Underwriters' approved* fire protection. Duty can be intermittent or continuous; both single and multi-stage units, with the type of drive you desire, are available, meeting widest head and capacity conditions. Pump and driver are engineered as a unit, tested in a modern hydraulic laboratory that duplicates actual field conditions, to match or exceed purchasers' expectations.

Plan with Peerless for all your needs for pumps. Peerless field and sales engineers are located in all principal cities to help you whenever and wherever there's a pump in your plans. For pump engineering information or service, call on them, or if you prefer, write for the latest pump engineering data. The chart at the right lists a number of the types of Peerless horizontal pump bulletins in which you will be interested.

DO YOU HAVE THE LATEST PUMP DATA?

Informative Engineering Bulletins Available From Peerless Pumps

Here are a few of the services Peerless Pumps perform. Request data by Bulletin number.

Pump Service	Bulletin No.
Water Supply	B-1300
Fire Protection	B-1500
Chemicals and Oils	B-810
Vaporous Liquids	B-2201
Butane-Propane	B-2200
Boiler Feed	B-301
Sewage and Solids	B-154
Hi-Pressure	B-310
Acids and Caustics	D-2400
Process Services	B-803
All-purpose Pumps	B-2301

PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Los Angeles, California — Indianapolis, Indiana

District Offices: New York 5, 37 Wall St.; Chicago 40, 4554 N. Broadway; St. Louis 8, 3908 Olive St.; Atlanta Office: Rutland Bldg., Decatur, Ga.; Omaha, Nebr., 4330 Leavenworth St.; Dallas 1, Tex., 3905 Elm St.; Fresno, Calif.; Los Angeles 31, Calif.

Peerless

VERTICAL AND HORIZONTAL

Pumps

first

AND THE LAST WORD
in forged steel fittings for all industries...

CARBON STEEL
Low Sulphur, Low Phosphor
High Tensile, High Weldability

ALLOYS
Stainless types 304—316—347
Chrome Moly—Carbon Moly—
Chrome Carbon Moly—Monel
Special alloys for Low Temperatures

W-S on Forged Steel Fittings, produced in commercial quantities—has been and still is the last word in dependable, trouble-free screw end and socket weld fittings service for ALL INDUSTRIES. Here's Why:

Reflected in the manufacture of every W-S *Forged* Fitting is a specialized knowledge of its end use by a particular industry. Beginning with selection of the right material from a wide choice of carbon and chrome-alloy steels, each W-S *Forged Steel* Fitting is tailor-made for a specified application:

Is high temperature, high-pressure STRENGTH a problem? W-S has been supplying intermediate alloy fittings to the power industry for many years. Want CORROSION RESISTANCE? W-S provides a full range of the popular stainless grades for all chemical processing requirements. Need PROTECTION against contamination and discoloration? Many food and drug processing plants use W-S 18-8, type 304, for full assurance of SANITATION... have for years. Plagued by INTERRUPTED SERVICE due to fittings failure under conditions of shock, vibration, and erosion? Industry after industry ... and commercial and institutional users as well... have discovered the long-range ECONOMY of forged, life-of-the-system joints, as compared to any other kind.

Be sure that you have the right answer to your next fittings problem ... before it arises: write for W-S Bulletin A-3, today.

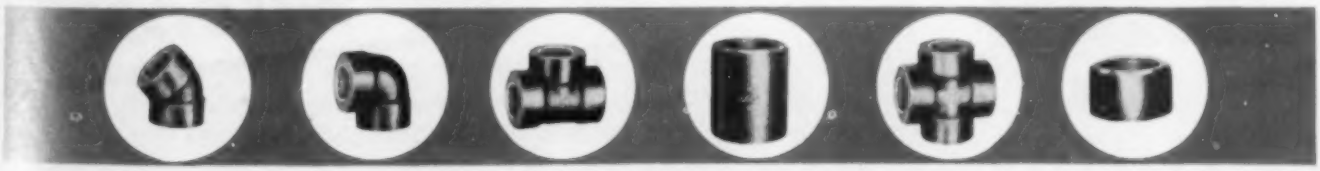
50A

WATSON-STILLMAN

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

ROSELLE, NEW JERSEY *Established 1848*

SOLD THROUGH LEADING DISTRIBUTORS



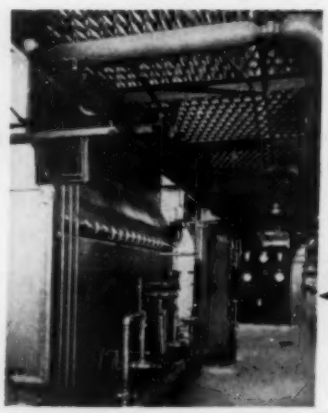
The Shamrock

Architect—Wyatt C. Hedrick
Construction Managers—Stone & Webster Engineering Corp.
General Contractors—Tellepsen Construction Co.

A NEW SUPERLATIVE FOR TEXAS ...served by B&W STEAM

Typical of Texas oilman-industrialist Glenn McCarthy's vision is Houston's spectacular and spacious Shamrock . . . a new superlative in Hotels. Typical, also, of his uncompromising insistence upon the quality and dependability of its services was the selection of B&W Boilers for this latest and largest monument to gracious living in the South.

Designed for efficiency as well as beauty and comfort, the Shamrock is served by three B&W Integral-Furnace Boilers with an aggregate capacity of 80,000 lbs. per hour of steam.



Supplying boilers for buildings that mark progress — from a "hotel that's measured in acres" to the most modest public or institutional edifice — is an 80 year old story with B&W — a good reason why it pays to consult B&W about steam-generating equipment for any type of building — or institutional plant.

WORTH LOOKING INTO NOW
FOR LOW-COST STEAM TOMORROW

BABCOCK & WILCOX

Over 500 Industrial Plants, Buildings, Institutions, Hotels, Schools and Hospitals now served by B&W INTEGRAL-FURNACE BOILERS, TYPE FF

G-410

They came to see Webster Baseboard Heating at this open house . . . and stayed to live

Mayfair Apts., Aberdeen, S. D., one of ten identical apartment buildings featuring Webster Baseboard Heating. Built by The Acme Company, Sheldon F. Reese, President. Architect: U. L. Freed. Plumbing and Heating: Tri-City Plumbing & Heating Company. Mortgagee: Midland National Life Insurance Company. FHA approved. Commitment was $1,000,000 or $1,753 per room. Rental is $19 per room, including heat, water and janitor service.

WEBSTER Baseboard Heating was a hit of the open house at this modern apartment village in Aberdeen, S. D.

"Webster Baseboard Heating shared honors with the all-electric kitchens for the widest interest and greatest approval," says Sheldon F. Reese, president of The Acme Company, project owners. "It was one of the big selling points."

Clean heat

Webster Baseboard Heating is perfected hot water heating installed behind a specially-designed metal baseboard around the exposed walls. *Less than 2 degrees variation* between floor and ceiling.

Webster Baseboard Heating is *clean* heat, *convected* heat . . . *radiant* heat in its most practical form. Heating is always gentle and mild yet fully adequate to provide comfort even with sub-zero temperatures. Gives you complete freedom in arranging room interiors. Nothing to interfere with drapes, curtains or furniture. No scorched or soiled furnishings.

More economical, more uniform heat

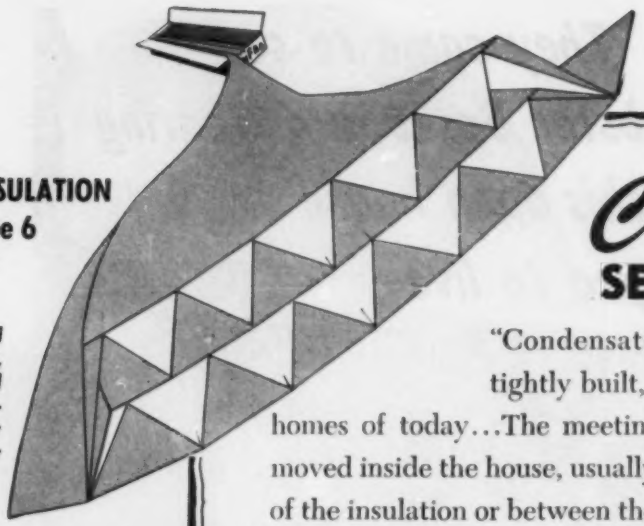
In Webster Baseboard Heating, air enters at floor line, passes over finned copper heating element, is warmed, then flows out of the top of the baseboard, supplying constant, even circulation. Fuel consumption is at a minimum. Simplified installation reduces cost. Fuel can be gas, oil or coal. Your heating contractor can install it.

Whether it is heating for an individual residence or for a project like Mayfair Apartments, get the facts about Webster Baseboard Heating. Now in operation in more than 10,000 homes. Webster Baseboard Heating is a development of Warren Webster & Company, an organization with more than 60 years leadership in heating systems.

Leading heating contractors right now are building their business plans around Webster Baseboard Heating. Let the Webster Representative in your locality give you further details.

Address Dept. HP-12 Warren Webster & Co.: Camden 5, N. J.: Representatives in Principal Cities: *In Canada, Darling Bros., Ltd., Montreal*

Webster
BASEBOARD HEATING



INFRA INSULATION
Type 6

Cost of Infra installed between wood joists, for material and labor, should be under 10¢ per sq. ft. for Type 6; under 8¢ for Type 4.

Condensation SEVERE PROBLEM

"Condensation...severe problem in the tightly built, well-insulated, high humidity homes of today...The meeting place of warm and cold is moved inside the house, usually somewhere in the outer layer of the insulation or between the insulation and the sheathing. The vapor then collects inside the attic or the walls and the result is plenty of trouble.

"Wet spots on the ceiling or walls, as the moisture flows down from the cold attic space; falling plaster as an end result; constant and repeated paint failures on the outer walls and gable ends; and rotting rafters, joists, studs, sheathing, and shingles or siding; these are only too common and costly results of the over-insulated, under-moisture-proofed home.

"The easiest solution, of course, is the inclusion of a good vapor barrier when the house is built...A series of laboratory tests made by the Forest Products Laboratory and the University of Wisconsin in 1947...Aluminum foil had by far the best rating as a vapor barrier."

From "Weather-Conditioning of Roofs for Residences" by Groff Conklin, "Progressive Architecture," Nov. 1949.

Infra Solves the Problem

INFRA Insulation, Type 6, is an impermeable vapor barrier, it weighs but 1¼ oz. per sq. ft. With so little thermal capacity there is practically no exchange of heat for condensation to take place. The construction—4 inner rows of reflective air cells of slight conduction, between 3 radiant-heat-repelling aluminum sheets of only 3% emissivity, effectively prevents contact of condensation-forming temperature extremes.

Infra, which cannot form, absorb nor store appreciable moisture, has 97% efficiency in rejecting radiant heat, which represents 65% to 80% of heat flow thru wall spaces. It is also singularly effective in blocking conduction and convection heat transfer.

THERMAL FACTORS, INFRA TYPE 6

Down-Heat	**C.044, R 22.72**	**= 7½" dry rockwool**
Up-Heat	**C.08, R 12.50**	**= 4" dry rockwool**
Wall-Heat	**C.073, R 13.69**	**= 4½" dry rockwool**

USE THE COUPON FOR A FREE COPY

of the National Bureau of Standards Bulletin, "Moisture Condensation in Building Walls," and for documented details about Infra.

Infra Insulation, Inc., 10 Murray St., New York 7, N. Y.

Please send me "Moisture Condensation in Building Walls" Bulletin of the National Bureau of Standards and data on Infra Insulation.

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ADDRESS_____

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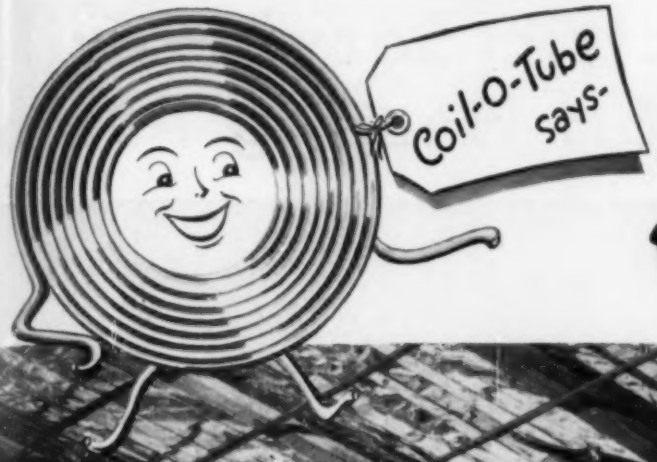
TITLE_____ AC

MULTIPLE ACCORDION ALUMINUM & TRIANGULAR REFLECTIVE AIR CELLS

Infra INSULATION, INC.
10 Murray St., N. Y., N. Y.



IT'S A LONG TIME BETWEEN JOINTS

● Long lengths of easy-to-bend Revere Copper Water Tube are real time-savers on any radiant panel heating job. In the first place, you need fewer tools to form radiant heating coils with this readily-bent tube. Then, as Coil O'Tube says, "It's a long time between joints"; and when you do make joints, you do it quickly and easily with solder fittings. The light weight of this tube simplifies handling, and, for ceiling installations, lessens the load.

All of these time-saving advantages save money for you. So, on your future radiant panel heating jobs, figure the cost with Revere Copper Water Tube . . . and you'll be using this easy-to-install tube every time.

Revere Copper Water Tube is stamped at regular intervals with the Revere name and the type. Look for these marks! They are more than identification . . . they are your assurance of easy bending and of the close dimensional tolerances so essential for tight soldered joints.

NOW IT'S EASY TO DESIGN FOR RADIANT PANEL HEATING!

Write today for your free copy of "A Simplified Design Procedure for Radiant Panel Heating." This booklet contains all the facts you need to accurately design floor or ceiling systems for the average residence or other non-mechanically-ventilated structure. It's the simplest, most rapid method of design ever published!

REVERE

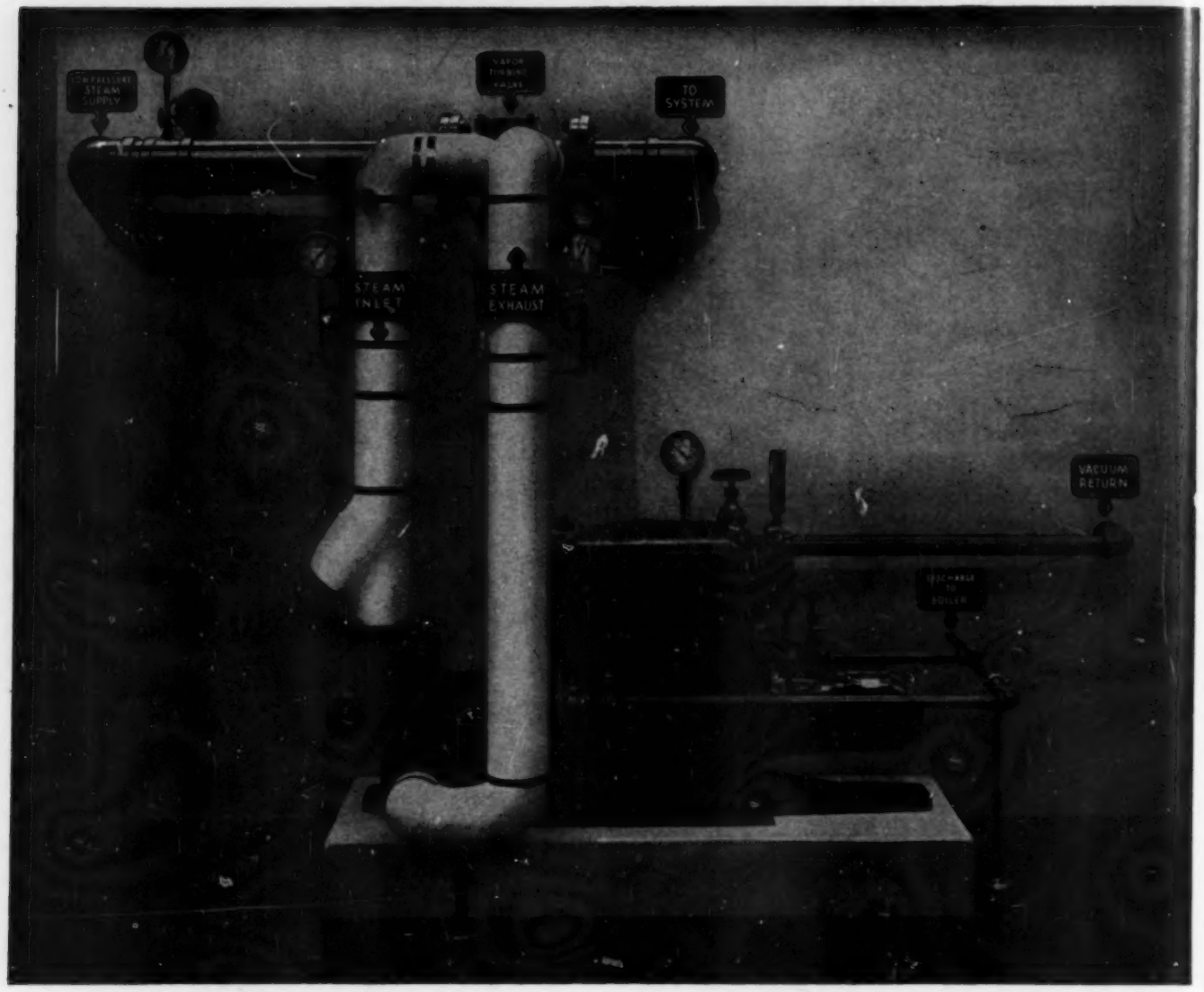
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

Interrupted Electric Service will not stop this NASH Heating Pump



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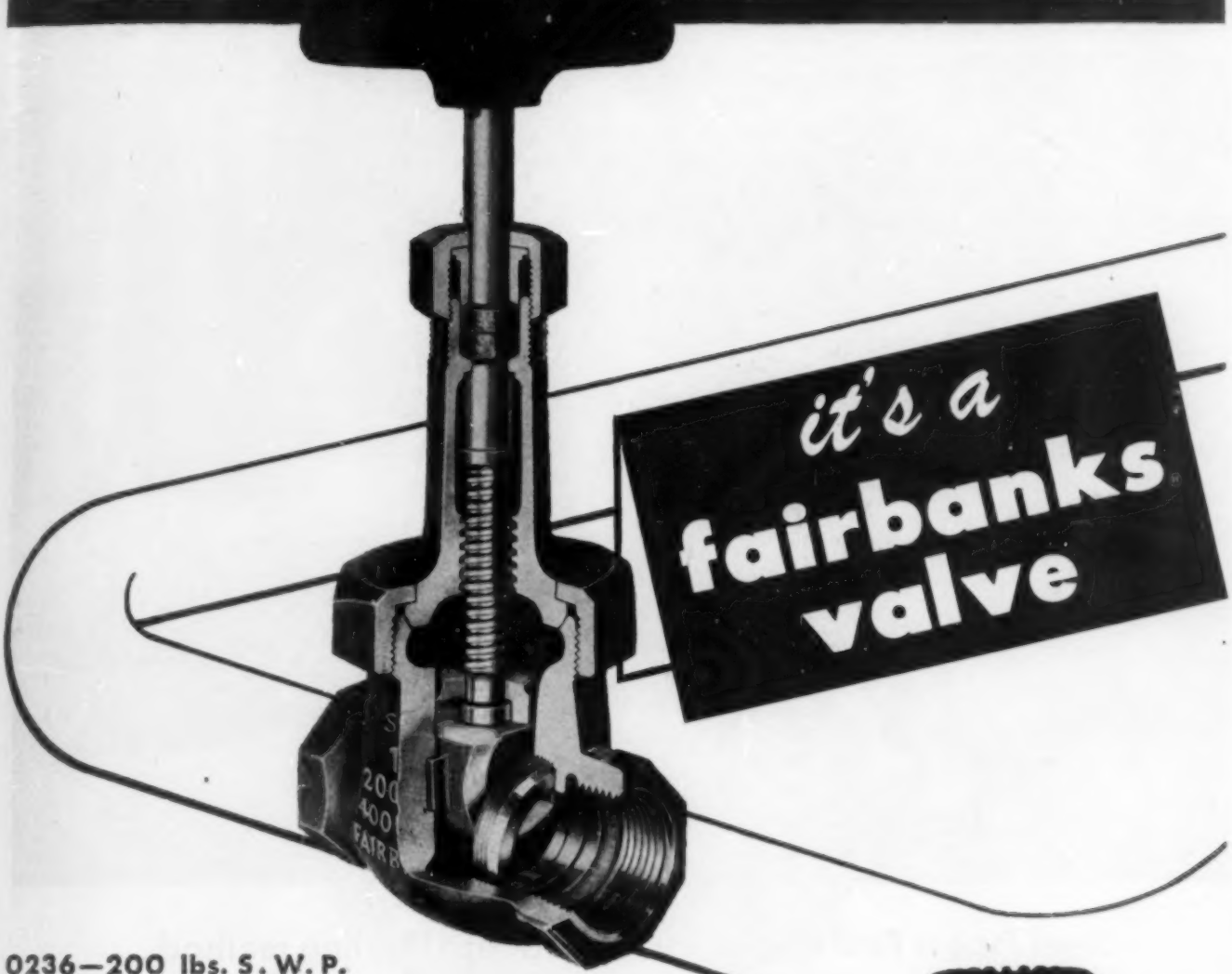

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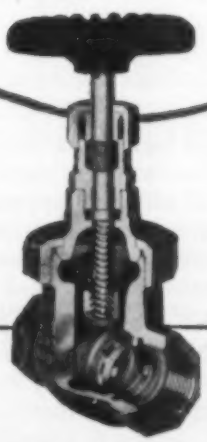

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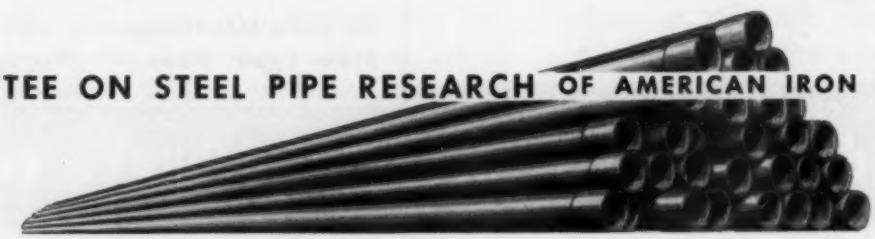

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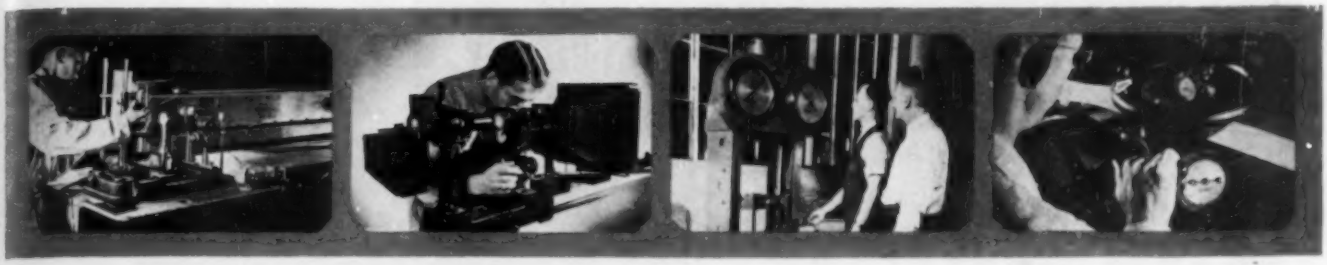

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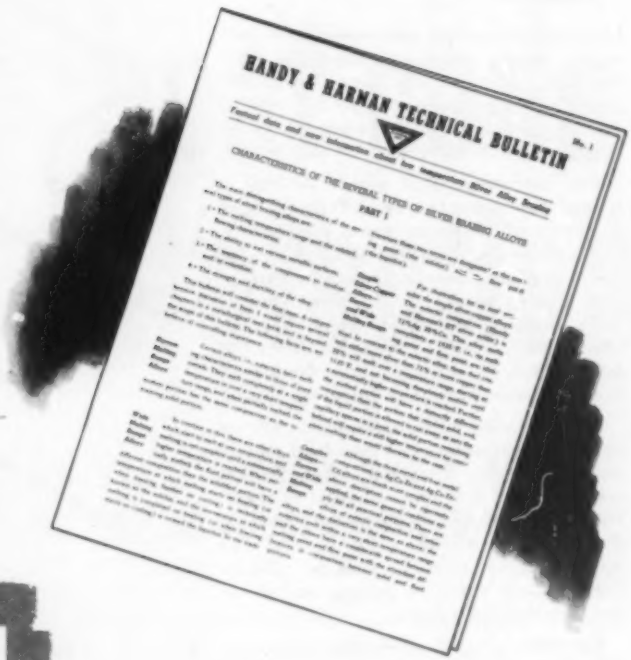
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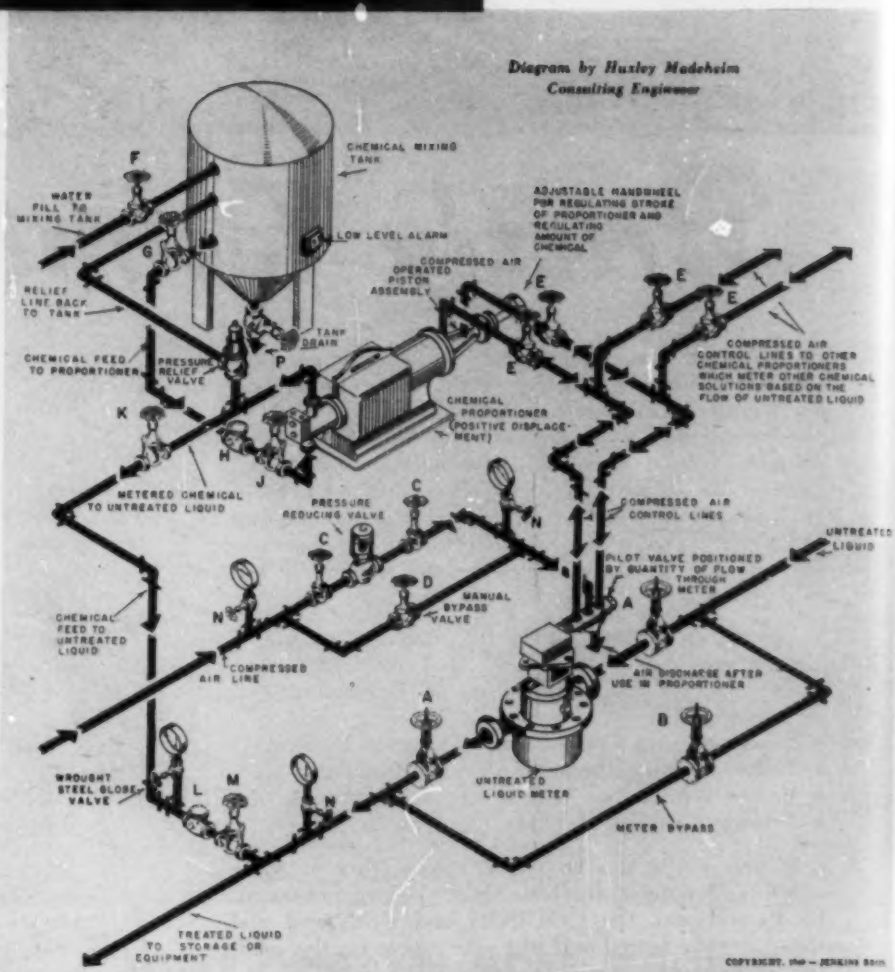
Jenkins PRACTICAL PIPING LAYOUTS 45

How to plan a DIRECT ADMISSION SYSTEM FOR CHEMICAL TREATMENT OF FLUIDS

Diagram by Hurley Madeheim, Consulting Engineer


CHEMICAL MIXING TANK
WATER FILL TO MIXING TANK
LOW LEVEL ALARM
ADJUSTABLE HANDWHEEL FOR REGULATING STROKE OF PROPORTIONER AND REGULATING AMOUNT OF CHEMICAL
COMPRESSED AIR OPERATED PISTON ASSEMBLY
RELIEF LINE BACK TO TANK
TANK DRAIN
CHEMICAL FEED TO PROPORTIONER
PRESSURE RELIEF VALVE
CHEMICAL PROPORTIONER (POSITIVE DISPLACEMENT)
COMPRESSED AIR CONTROL LINES TO OTHER CHEMICAL PROPORTIONERS WHICH METER OTHER CHEMICAL SOLUTIONS BASED ON THE FLOW OF UNTREATED LIQUID
METERED CHEMICAL TO UNTREATED LIQUID
PRESSURE REDUCING VALVE
COMPRESSED AIR CONTROL LINES
UNTREATED LIQUID
PILOT VALVE POSITIONED BY QUANTITY OF FLOW THROUGH METER
MANUAL BYPASS VALVE
CHEMICAL FEED TO UNTREATED LIQUID
COMPRESSED AIR LINE
AIR DISCHARGE AFTER USE IN PROPORTIONER
WROUGHT STEEL GLOBE VALVE
UNTREATED LIQUID METER
METER BYPASS
TREATED LIQUID TO STORAGE OR EQUIPMENT

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The untreated fluid passes through a special flow meter that records the amount of flow and also operates a pilot valve. Valve, in turn, regulates the flow of an operating fluid, usually compressed air, to and from a piston in the proportioner. This piston is directly connected to another which draws in chemical from the mixing tank on one stroke and discharges it on the return into the untreated liquid.

A single pilot valve can operate one or more proportioners, and thus feed one or more different chemicals into the untreated liquid flow line. Amount of chemical discharged can be varied by changing the length of stroke, controlled by the handwheel. *Fig. 40-A,* Jenkins all-iron U-Bolt Gate Valve, is recommended for the chemical feed lines.

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Diagram by Hurley Madeheim, Consulting Engineer

Code	Quan.	Jenkins Valves	Service
A	2	Fig. 677-A Bronze Gate	Meter Shutoff Valves
B	1	Fig. 677-A Bronze Gate	Meter Bypass
C	2	Fig. 47 Bronze Gate	Pressure Reducing Valve Shutoff
D	1	Fig. 106-A Bronze Globe	Manual Control Bypass
E	4	Fig. 106-A Bronze Globe	Air Control Line Shutoff Valves
F	1	Fig. 106-A Bronze Globe	Fill Valve
G	1	Fig. 40-A All Iron Gate	Mixing Tank Feed to Proportioner Shutoff
H	1	Fig. 623 IB Swing Check	Prevent Backflow to Tank
J	1	Fig. 40-A All Iron Gate	Proportioner Chemical Suction Shutoff
K	1	Fig. 40-A All Iron Gate	Chemical Discharge Shutoff
L	1	Fig. 623 IB Swing Check	Prevent Backflow to Proportioner
M	1	Fig. 40-A All Iron Gate	Chemical Feed to Untreated Liquid Shutoff
N	3	Fig. 743-G Bronze Needle	Pressure Gage Control
P	1	Fig. 75-A All Iron Globe	Chemical Tank Drain

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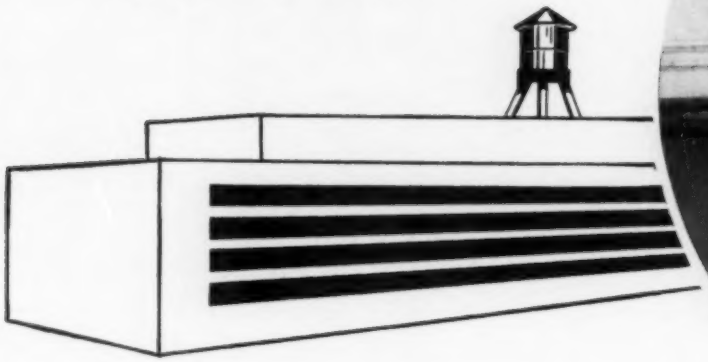

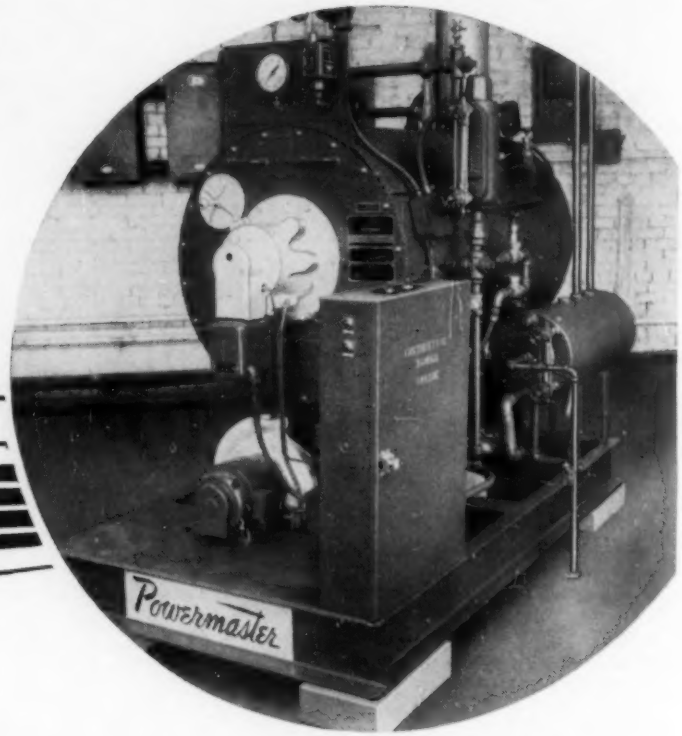

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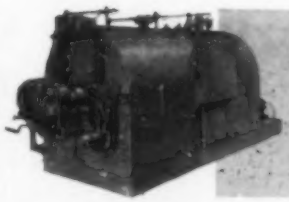

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INDEX TO ADVERTISERS

Acme Industries, Inc. ... *
Aerofin Corp. ... 162
Air Conditioning Products Co. ... 177
Air Correctives, Inc. ... *
Air Devices, Inc. ... *
Air Filter Corp. ... 170
Air-Maze Corp. ... 143
Air Purification Service, Inc. ... *
Airtemp Div. of Chrysler Corp. ... 147
Airtherm Mfg. Co. ... 153
Aladdin Heating Corp. ... *
Alco Valve Co. ... 37
Aldrich Co. ... 150
Allen-Bradley Co. ... *
Alliance Mfg. Co. ... 176
Allis-Chalmers Mfg. Co. ... 6 & 24
American Air Filter Co., The ... 48
American Blower Corp. ... 35
American Brass Corp., The ... *
American District Steam Co. ... 148
American Instrument Co. ... 166
American Pipe Bending Machine Co., Inc. ... 183
American Radiator & Standard Sanitary Corp. ... *
Ames Iron Works ... *
Anderson Co., V. D. ... *
Anemostat Corp. of America ... 182
Arabol Mfg. Co., The ... *
Armstrong Cork Co. ... 30
Armstrong Machine Works ... *
Auer Register Co. ... 184
Aurora Pump Co. ... 182
Autempco Corp. ... 184
Automatic Switch Co. ... 163
Auto Radiator Specialty Co. ... 172

Babcock & Wilcox Co. ... 60
Bacharach Industrial Instrument Co. ... *
Badger Manufacturing Co. ... 152
Baker Refrigeration Corp. ... *
Baltimore Aircoil Co. ... *
Barber-Colman Co. ... *
Barnes & Jones, Inc. ... *
Bauer & Black Div. of Kendall Co. ... *
Bear Mfg. Co. ... *
Bell & Gossett Co. ... 17
Binks Mfg. Co. ... 169
Bishop & Babcock Mfg. Co., The ... 179
Black & Decker Mfg. Co. ... 171
Bonney Forge & Tool Works ... *
Brown Instruments Division Minneapolis-Honeywell Regulator Co. ... 54
Brown Products Co. ... *
Brownell Co., The ... *
Brunner Mfg. Co. ... 47
Bryant Heater ... 149
Buffalo Forge Co. ... 8 & 9
Buffalo Pumps, Inc. ... 52
Bundy Tubing Co. ... *
Bush Mfg. Co. ... *
Byers Co., A. M. ... 4

Campbell Heating Co. ... *
Carnegie-Illinois Steel Corp. ... 18
Carrier Corp. ... 50
Cash Co., A. W. ... *
Century Electric Co. ... 28
Chase Brass & Copper Co. ... *
Chicago Pump Co. ... 145
Clarage Fan Co. ... Inside Back Cover
Clark Mfg. Co., The ... 183
Cleaver-Brooks Co. ... *
Columbia Steel Co. ... 18
Combustion Control Corp. ... 56
Combustion Engineering—Superheater Inc. ... 151
Committee on Steel Pipe Research of American Iron & Steel Institute ... 134
Condenser Service & Engineering Co. ... 179
Connor Engrg. Co., W. B. ... 7 & 31
Continental Air Filters, Inc. ... *
Cork Import Corp. ... *
Couplings Co., The ... *
Crane Co. ... 29
Curtis Refrigerating Machine Co. ... *

Davis Engineering Corp. ... *
De Bothezat Fans Division American Machine & Metals, Inc. ... 157
Delco Motors Div. of General Motors Corp. ... 34
Detroit Lubricator Company ... *
Detroit Stoker Co. ... *
Dollinger Corp. ... *
Doyle & Roth Mfg. Co. ... *
Dravo Corporation ... *
Dunham Co., C. A. ... 10
Durant Insulated Pipe Co. ... *
Duriron Co., Inc., The ... 163
Dutton Company, C. H., Inc. ... 185

Eagan Co., Walter H. ... *
Eclipse-Pioneer Div. Bendix Aviation Corp. ... 169
Economy Pumps, Inc. ... *
Elco Tool & Screw Corp. ... *
Emerson Elec. Mfg. Co. ... 135
Enterprise Engine & Foundry Co. ... *

Fairbanks Co. ... 133
Fairbanks Morse & Co. ... 11
Farr Co. ... *
Fedders-Quigan Corp. ... 164
Fisher Governor Co. ... *
Fitzgibbons Boiler Co., Inc. ... *
Foster Wheeler Corp. ... *
Frick Co. ... 165
Fulton Sylphon Co. ... *

G. & O. Mfg. Co., The ... *
Gardner-Denver Co. ... *
Genetal Controls Co. ... 177
General Fittings Co. ... 51
General Gas Light Co. ... *
General Oil Burner Corp. ... 176
Germatrol Corp. ... *
Glasfloss Corp., The ... *
Grinnell Co., Inc. ... Inside Front Cover

H & H Tube and Mfg. Co. ... 55
Hajoca Corporation ... *
Hamilton-Thomas Corp. ... 160
Handy & Harman ... 137
Haney Gas Burners & Engineers ... *
Hastings Instrument Co., Inc. ... *
Hayes Furnace & Mfg. Co., Inc. ... 53
Hays Corp. ... 180
Hendrick Mfg. Co. ... 165
Hoffman Specialty Co. ... *
Howell Electric Motors Co. ... 19
Hussey & Co., C. G. ... 39

Ilg Electric Ventilating Co. ... 146
Illinois Engineering Co. ... 140
Illinois Testing Laboratories, Inc. ... *
Independent Register Co. ... 157
Infra Insulation, Inc. ... 64
Ingersoll-Rand ... 177
Ingersoll Steel Div. Borg-Warner Corp. ... *
Iron Fireman Mfg. Co. ... *

Jan-Air, Inc. ... *
Jefferson Union Co., Inc. ... 177
Jenkins Bros. ... 138
Jenn Air Products Co. ... *
Johns-Manville ... 167
Johnson Heater Corp. ... *
Johnson Service Co. ... *
Joy Mfg. Co. ... *

Kaiser Aluminum & Chemical Sales, Inc. ... 173
Kennard Corp. ... *
Kewanee Boiler Corp. ... 32
Key Co. ... *
Kieley & Mueller, Inc. ... *
Kinetic Chemicals, Inc. ... *
Klipfel Valves, Inc. ... 160
Korfund Co., Inc. ... *
Kritzer Radiant Coils, Inc. ... 156

Ladish Co. ... 141
Lake Chemical Co. ... *
Lancaster Heat Transfer Co., Inc. ... *
Lee Engineering Co. ... 154
Lincoln Electric Co., The ... *
Lunkenheimer Co., The ... *

Marley Co., The ... *
Marlo Coil Co. ... 42
Marsh Heating Equipment Co. ... *
Mortocello & Co., Jos. A. ... 178
McCord Corp. ... *
McDonnell & Miller, Inc. Outside Back Cover
Mercoid Corp., The ... 183
Mettler Co., Lee B. ... *
Midwest Piping & Supply Co. ... *
Milton Equipment Co. ... 184
Minneapolis-Honeywell Regulator Co. ... 41
Miracle Adhesives Corp. ... *
Modine Mfg. Co. ... 25 & 44
Moore Company, The ... *
Mueller Furnace Co. ... *
Multi-Vent Div., Pyle National Co. ... 40
Mundet Cork Corp. ... *

Nash Engineering Co. ... 68
National Metal Fabricators ... *
Nelson Corp., Herman ... *
Nesbitt J. J. ... *
New York Blower Co., The ... *
Niagara Blower Co. ... *
Nicholson & Co., W. H. ... 176

Ohio Injector Co. ... *
Olson & Company, Arthur A. ... 181
Orr & Sembower, Inc. ... 142
Owens-Corning Fiberglas Corp. ... 155

Paddock Sales ... *
S. Parker Hardware Mfg. Corp. ... *
Parsons, O. J. ... *
Patterson-Kelley Co., Inc., The ... 167
Peerless Elec. Co. ... *
Peerless Pump Div., Food Machinery and Chemical Corp. ... 58
Porter & Co., H. W. ... *
Powers Regulator Co., The ... 38
Prat-Daniel Corp. ... 158
Pritchard Co., J. F. ... 46
Products Research Co. ... *
Propellair, Inc. ... *

Randall Graphite Bearings, Inc. ... *
Raytheon Mfg. Co. ... *
Reinhard Brothers Co. ... *
Rempe Co. ... 179
Revere Copper & Brass, Inc. ... 67
Reynolds Metals Co. ... *
Reznor Mfg. Co. ... 178
Rhoads & Sons, J. E. ... 136
Ric-wiL Co., The ... 33
Ridge Tool Co. ... 21
Rittling Corp. ... *
Rotary Concrete Drill Co. ... *
Roth Co., Roy E. ... *
Ruppright Siegfried ... *
Russell Elec. Co. ... 180

Sall Mountain Co. ... *
Sangamo Electric Co. ... 173
Sante Fe Tank & Tower Co. ... 181
Sarco Co., Inc. ... 13
Sarcotherm Controls, Inc. ... 12
Scovill Mfg. Co. ... *
Sellers Engineering Co. ... *
Skidmore Pumps ... 181
Socony-Vacuum Oil Company, Inc. ... *
Southwest Air Conditioning Exposition ... 175
Spang-Chalfant Div. of The National Supply Co. ... 15
Spencer Heater Div., Avco Mfg. Corp. ... *
Sporlan Valve Co. ... *
Standard Stamping & Perforating Co. ... 184
Steel Products Engineering Co., The ... *
Stemco Corp. ... 159
Stephens-Adamson Mfg. Co. ... *
Sterling, Inc. ... *
Stic-Klip Mfg. Co. ... 179
Strong, Carlisle & Hammond Co. ... 174
Sturtevant Co., B. F., Div. of Westinghouse Elec. ... *
Superior Combustion Industries Inc. ... 23
Surface Combustion Corp. ... *
Swartwout Co. ... *

Tal Bender, Inc. ... *
Taylor Forge & Pipe Works ... 43
Taylor Instrument Companies ... *
Tennessee Coal, Iron & R. R. Co. ... 18
Thrush & Co., H. A. ... 20
Titus Mfg. Corp. ... *
Todd Shipyards Corp. (Combustion Equipment Div.) ... 168
Trane Co., The ... 22
Tube Turns, Inc. ... *
Tuttle & Bailey, Inc. ... 26
Typhoon Air Conditioning Co., Inc. ... *

United Cooling Tower Co. ... *
United States Air Conditioning Co. ... 3
U. S. Machine Corp. ... *
United States Steel Corp. ... 18
United States Steel Export Co. ... 18
United States Steel Supply Co. ... 18
Up-Right Scaffolds ... *

Vulcan Radiator Co. ... *

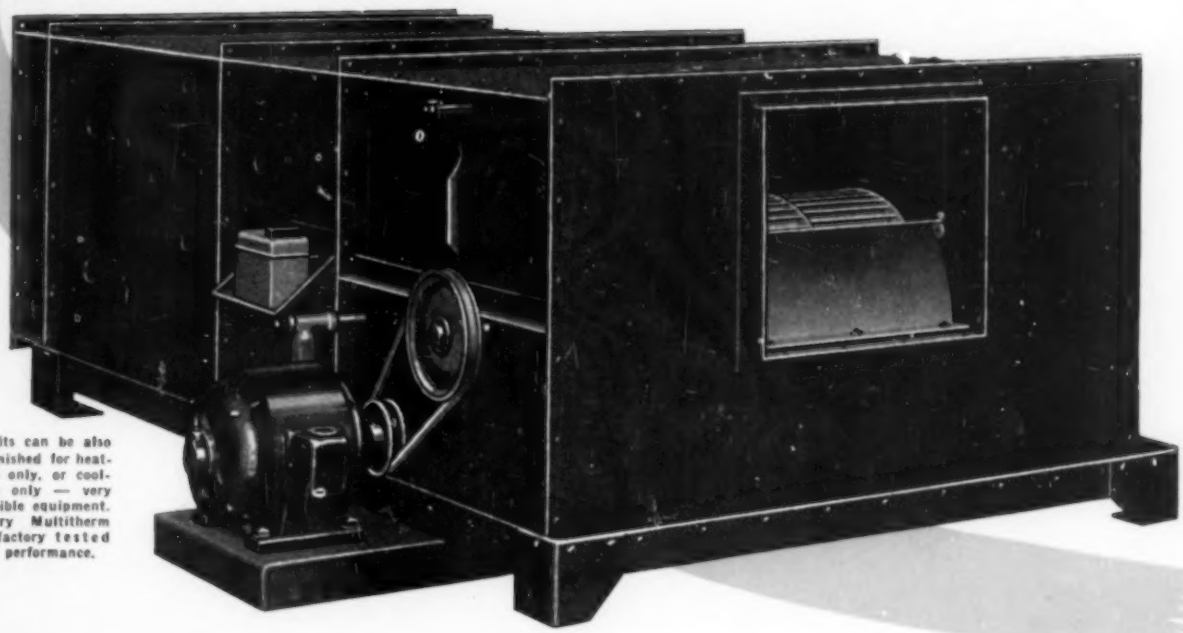
Wagner Electric Corp. ... 14
Walton Laboratories, Inc. ... 175
Walworth Co. ... 45
Ward Leonard Elec. Co. ... 144
Watson-Stillman Co. ... 59
Webster & Co., Warren ... 63
Webster Engineering Co., The ... *
Weil Pump Co. ... *
Weinman Pump Mfg. Co. ... 171
Weirton Steel Co. ... *
Welding Fittings Corp. ... *
Westinghouse Elec. Corp. ... *
Wheatland Tube Co. ... 57
Wheeler Mfg. Co., C. H. ... *
White-Rodgers Electric Co. ... *
Whitlock Mfg. Co. ... *
Whittington Pump & Engrg. Corp. ... *
Wiegand Co., Edwin L. ... 181
Williams & Co., J. H. ... *
Wilson & Co. ... *
Wilson, Inc., Grant ... 161
Wing Mfg. Co., L. J. ... 49
Wolverine Tube Div. of Calumet & Hecla Consolidated Copper Corp. ... *
Worthington Pump & Machinery Corp. ... 27

Yarnall-Waring Co. ... 159
York Corp. ... 16
Young Radiator Co. ... 183
Youngstown Sheet & Tube Co. ... 36

Zallea Bros. ... *
Zink Co., John ... 161
Zonolite Company ... *

Firms represented in this issue are identified by the folio of the page on which their advertising appears. Advertising which appears in other issues is marked with an asterisk.

HERE'S ONE OF THE MOST EFFICIENT WAYS TO AIR CONDITION!



*Units can be also furnished for heating only, or cooling only — very flexible equipment. Every Multitherm is factory tested for performance.

MULTITHERMS—WHOLE "WORKS" IN ONE ASSEMBLY . . . BUILT FOR ALL SORTS OF INDUSTRIAL AND COMMERCIAL APPLICATIONS

The Clarage Multitherm unit shown above is a complete conditioning plant* . . . (1) it *cleans* the air, removing bacteria, pollen and dust . . . (2) it *cools and debumidifies* in summer utilizing cold well water, brine or a direct expansion refrigerant . . . (3) it *heats and humidifies* in winter using steam or hot water . . . (4) it supplies at all times a circulation of conditioned air under positive fan pressure.

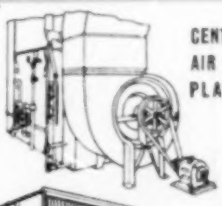
Multitherms are as easy and inexpensive to install as unit heaters — and just as satisfactory in operation. They may be suspended from the ceiling, mounted on platforms, or installed on the floor. Sizes range from 400 to 13,600 c.f.m. If the job is extra large, it can be handled with two or more units.

Look into Clarage Multitherms if you have any type of air conditioning problem. They are engineered to give precision results — compact to save space — of heavy duty construction for years of continuous trouble-free service. *And, as compared to central station conditioning, you can usually save considerable money.*

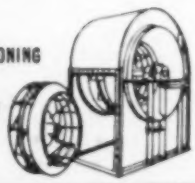
Write us, outlining your requirements — or ask for Bulletin 107 giving complete information.

SOME OF OUR OTHER PRODUCTS

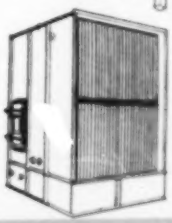
UNIT HEATERS



CENTRAL STATION AIR CONDITIONING PLANTS



AIR CONDITIONING AND VENTILATING FANS



AIR WASHERS

CLARAGE FAN COMPANY
Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

Sam, you better SCRAM!

Wipe off that worried look, Sam, it's Christmas!

The Sam-you-better-scram idea has had a big year—not a bit bigger, we feel, than it deserves—but a big year just the same.

So while the vital and basic idea of boiler protection merits success, we are no less aware of the great job our many friends in the heating industry have done in selling boiler protection throughout the tumultuous year of 1949.

Yes, considering the business trend, you did the best job for us in selling McDonnell products that you have ever done . . . and the fact that you were able to reverse the trend this year, shows that the Sam-you-better-scram idea is deserving of all the effort you have given it—even greater effort in the new year just around the corner.

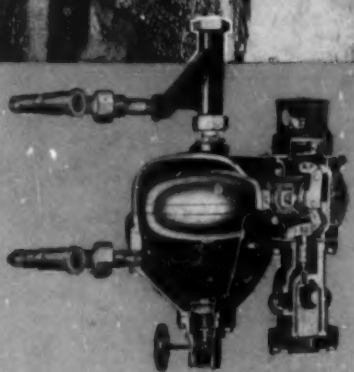
Meantime our thoughts touched off by the Christmas decorations that are popping up around town, race over the housetops and lakes and mountains and states like Saint Nick and his sleigh to extend a hearty thanks and a Merry Christmas to all.

Let's hope even Sam can wipe off that worried look for a handshake all around!

McDONNELL & MILLER, INC. 1316 Wrigley Bldg., Chicago 11, Ill.

Doing One Thing Well

Your Jobber Stocks Them



No. 47-2 Feeder-Cut-off Combination for boilers below 5000 sq. ft.; maximum steam pressure, 25 lbs. Quick-Hook-Up for speedy, correct installation.

No. 67 Low Water Cut-off for all automatically fired boilers; maximum steam pressure, 20 lbs.

No. 150 Water Level Control for boilers of any size with steam pressures up to 150 lbs. Used as feed-pump control; low-water fuel cut-off; low water alarm switch, or any combination of these functions.

McDONNELL

Boiler Water Level Controls